Preface

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- the purpose of this manual
- terms and abbreviations used
- conventions used in this manual

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley small logic controllers.

You should have a basic understanding of SLC 500™ products. If you do not, contact your local Allen-Bradley representative for the proper training before using this product.

We recommend reviewing the *APS Quick Start for New Users* before using the software.

Purpose of this Manual

This manual is a reference guide for the APS Import/Export utility. It describes the procedures you use to convert APS archive files and program documentation into ASCII text files, and vice versa.

Contents of this Manual

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Introducing the APS Import/Export Utility	Introduces you to the APS Import/Export utility and shows you how to start it.
2	Configuring the APS Import/Export Utility	Guides you through the configuration of the APS Import/Export utility.
3	Importing ASCII Documentation/Archive Files	Guides you through the configuration of the import utility and then the import operation.
4	Exporting APS Documentation/Archive Files	Guides you through the configuration of the export utility and then the export operation.
5	Creating an ASCII Archive File	Explains how to build an ASCII archive file, then provides examples.
6	Creating an ASCII Documentation File	Explains how to build an ASCII documentation file, then provides an example.
Appendix A	Programming Instruction References	Provides you with valid addressing modes and file types.

Related Documentation

The following documents contain additional information concerning RSI and Allen-Bradley SLC products. To obtain a copy, contact your local sales office or distributor.

For	Read this Document
An introduction to APS for first-time users, containing basic concepts but focusing on simple tasks and exercises, and allowing the reader to begin programming in the shortest time possible	APS Quick Start for New Users
A training and quick reference guide to APS	SLC 500 Software Programmer's Quick Reference Guide, Publication Number ABT-1747-TSG001—available on PASSPORT at a list price of $50.00
A guide of common procedures used in APS	SLC 500 Software Common Procedures Guide, Publication Number ABT-1747-TSJ50—available on PASSPORT at a list price of $50.00
A procedural manual for technical personnel who use APS to develop control applications	Advanced Programming Software (APS) User Manual
A reference manual that contains status file data and instruction set information for the SLC 500 processors and MicroLogix 1000 controllers.	Instruction Set Reference Manual
An overview of the SLC 500 family of products	SLC 500 System Overview, Publication Number 1747-2.30
A description on how to install and use your *Fixed* SLC 500 programmable controller	Installation and Operation Manual for Fixed Hardware Style Programmable Controllers, Catalog Number 1747-NM001
A description on how to install and use your *Modular* SLC 500 programmable controller	Installation and Operation Manual for Modular Hardware Style Programmable Controllers, Publication Number 1747-6.2
A complete listing of current documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index, Publication Number SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary, Publication Number AG-7.1

Terms and Abbreviations

The following terms and abbreviations are specific to this product. For a complete listing of Allen-Bradley terminology, refer to the Allen-Bradley Industrial Automation Glossary, publication number AG–7.1.

Archive File — a file, stored on a disk and in binary format, that contains an SLC 500 processor program.

Documentation File — a file, stored on a disk and in binary format, that contains rung, instruction, address comments and symbols.

APS — Advanced Programming Software.

APSIE — APS Import/Export utility.

ASCII — a group of alphanumeric characters that defines a line in an import file.

RSI — Rockwell Software, Inc.

SLC — small logic controller

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.
- Text in `this font` indicates words or phrases you should type.
- Key names match the names shown and appear in bold, capital letters within brackets (for example, **`[ENTER]`**). A function key icon matches the name of the function key you should press, such as **SAVE & EXIT** **F8** .

1 Introducing the APS Import/Export Utility

This chapter provides:

- an overview of the APSIE utility
- the system requirements
- the APSIE display format
- the APSIE menu display

This chapter also shows you how to:

- run the software
- start the utility

APSIE Overview

The APS import/export utility, APSIE, lets you convert:

- APS archive files and program documentation into ASCII text files
- ASCII text files that contain an SLC 500 program and program documentation into APS archive files

You install APSIE as you install APS, although it executes separately from APS. APSIE interacts with archive and documentation files generated by all versions of APS.

Another key feature of APSIE is its *Define Directory* function. This function lets you specify the drives and directories that APSIE reads files from and writes files to. With this capability you can have files in any MS–DOS directory. For more information on user directories, see chapter 2, Configuring the APS Import/Export Utility.

System Requirements

You can use APSIE with an Allen-Bradley T47 or T70 terminal, 386/SX, NEC VERSA™ E Series Notebook, or GATEWAY 2000™ models 386DX/25, 386DX/33, 486DX/33, 486DX2/50, and 486DX2/66 personal computers. Your computer must have:

- 640 Kbytes of RAM
- 10 Mbyte fixed-disk drive (APS requires 8.5 Mbytes of free disk space.)
- DOS version 3.3 or higher

The maximum number of archive, documentation, and ASCII files allowed by APSIE is limited solely by the available space on your floppy or fixed disk.

Running the Software

To run the APSIE software, follow these steps:

1. If necessary, change the drive specifier to the drive where the software is installed (typically C). To do this, type:

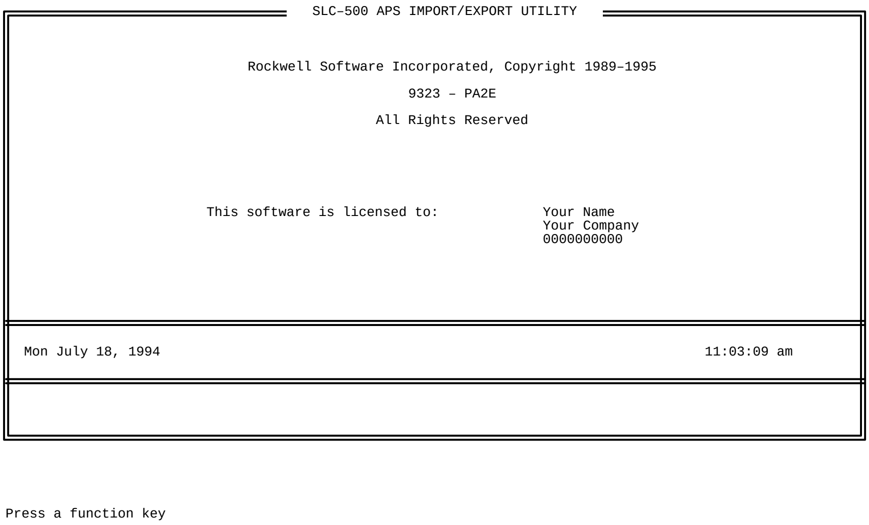
   C: and press **[ENTER]**.

2. If you are using the default directory, at the DOS prompt, type:

   CD \IPDS\ATTACH\SLC500 and press **[ENTER]**.

   If you specified a different directory path, change to that directory and press **[ENTER]**.

3. Type: **APSIE** and press **[ENTER]**. The import/export utility displays the main screen.



```
                         SLC–500 APS IMPORT/EXPORT UTILITY

                  Rockwell Software Incorporated, Copyright 1989–1995
                                   9323 – PA2E
                               All Rights Reserved



              This software is licensed to:             Your Name
                                                        Your Company
                                                        0000000000


 Mon July 18, 1994                                                   11:03:09 am



Press a function key
```

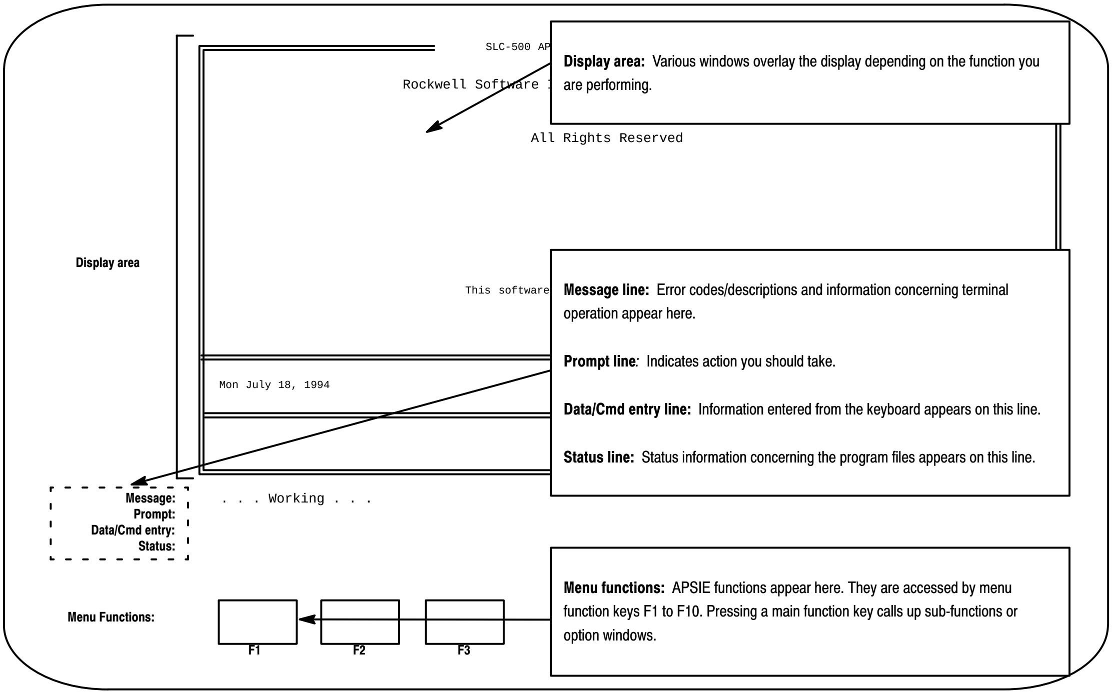
4. Become familiar with the APSIE display format and menu on pages 1-4 and 1-5. Then, go to the next section, Starting the Utility, to perform a task from the main menu.

APSIE Display Format

The APSIE screen is divided into three areas:

- display area
- message, prompt, data entry and status lines
- APSIE menu functions

The screen below indicates what appears in these areas.



Display area: Various windows overlay the display depending on the function you are performing.

Message line: Error codes/descriptions and information concerning terminal operation appear here.

Prompt line*:* Indicates action you should take.

Data/Cmd entry line: Information entered from the keyboard appears on this line.

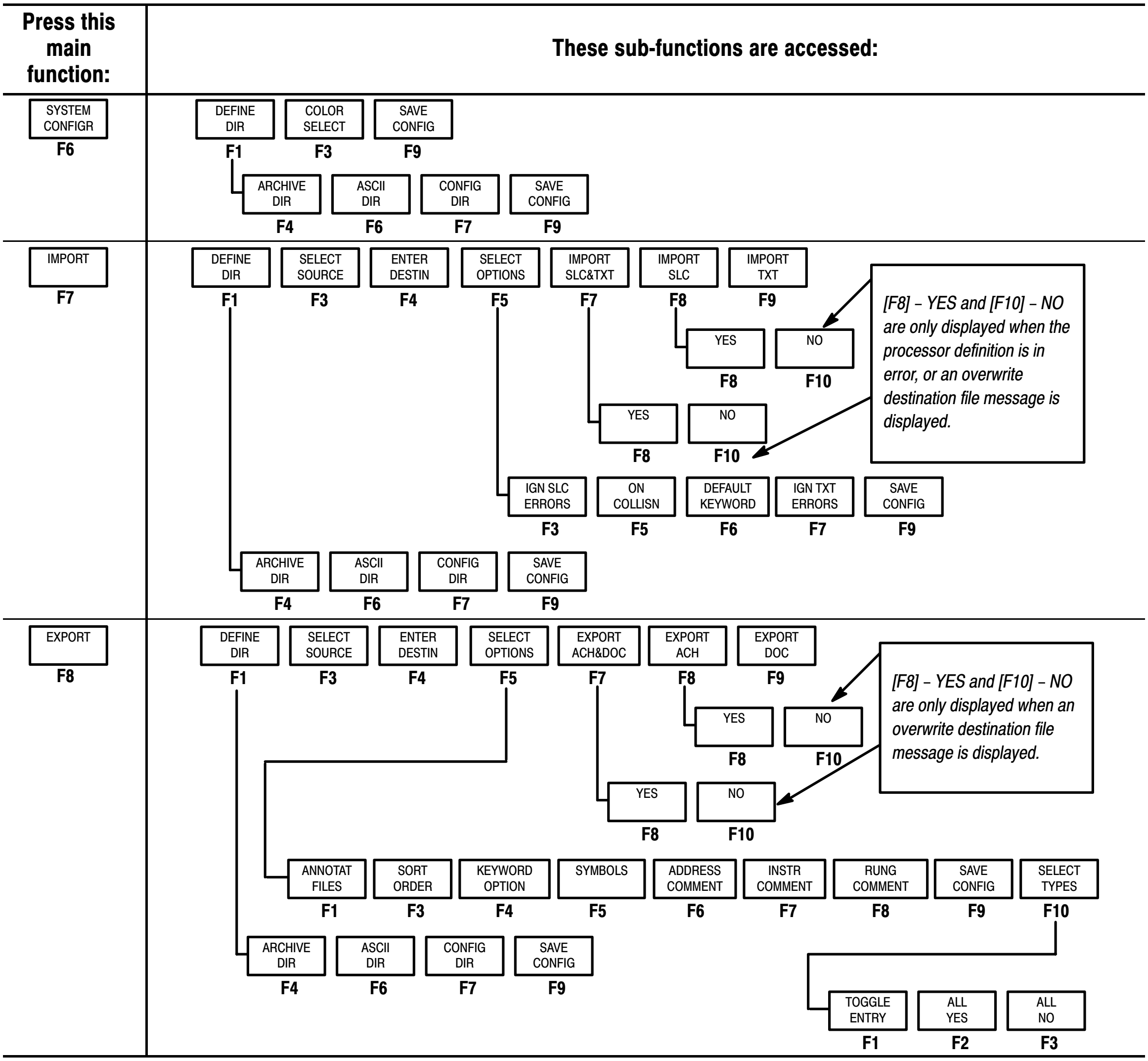
Status line: Status information concerning the program files appears on this line.

Menu functions: APSIE functions appear here. They are accessed by menu function keys F1 to F10. Pressing a main function key calls up sub-functions or option windows.

APSIE Menu Display

From the APSIE main menu there are three tasks that you can start. You can import ASCII files, export APS files, or configure the utility. As you press keys while running APSIE, various windows are displayed depending on the function you are accessing. The function keys also change as the windows change. See table 1.A.

Table 1.A
Function Keys — APSIE Menu Display



[F8] – YES and [F10] – NO are only displayed when the processor definition is in error, or an overwrite destination file message is displayed.

[F8] – YES and [F10] – NO are only displayed when an overwrite destination file message is displayed.

Starting the Utility

Select a task to perform from table 1.B.

Table 1.B
Selecting a Task from the Main Menu

If you want to:	Press:	Then:
configure the import/export utility	**[F6**] – SYSTEM CONFIGR	see chapter 2, Configuring the APS Import/Export Utility.
import a file	**[F7]** – IMPORT	see chapter 3, Importing ASCII Documentation/Archive Files.
export a file	**[F8]** – EXPORT	see chapter 4, Exporting APS Documentation/Archive Files.
exit the utility	**[F10]** – EXIT SYSTEM	APSIE software is terminated, the screen clears, and you are returned to DOS.

2 Configuring the APS Import/Export Software

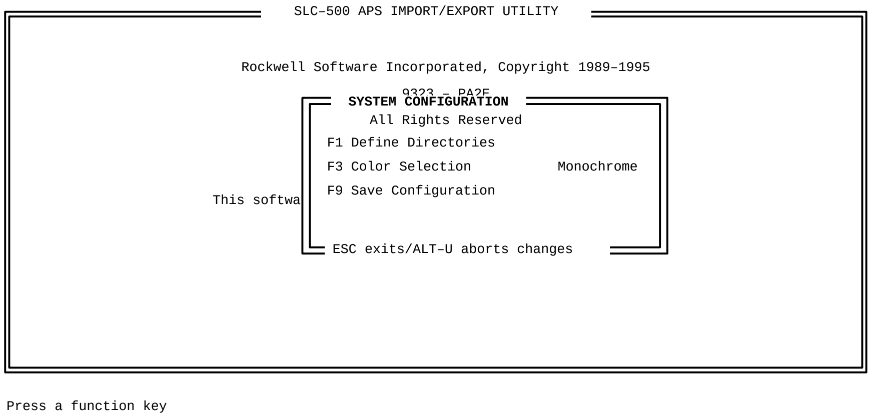
This chapter shows you how to:

- choose between color and monochrome screens. (You must have a color adaptor card and color monitor to use the color selection.)
- specify the user drives and directories

This chapter assumes that you have installed the APS/APSIE software and selected the [F6] – SYSTEM CONFIGR function key from the main menu. If not, see chapter 1, Introducing the APS Import/Export Utility.

Configuring the System

After selecting [F6] – SYSTEM CONFIGR, the import/export utility displays the system configuration screen.



```
                    SLC–500 APS IMPORT/EXPORT UTILITY

            Rockwell Software Incorporated, Copyright 1989–1995
                          9323 – PA2E
                   SYSTEM CONFIGURATION
                       All Rights Reserved
                  F1 Define Directories
                  F3 Color Selection          Monochrome
                  F9 Save Configuration
         This softwa

                   ESC exits/ALT–U aborts changes

Press a function key
```

From this menu you can do the following:

- choose color or monochrome screens
- define user directories
- save the configuration

Table 2.A explains what to do for either task.

Table 2.A
Specifying User Directories or Choosing between Color and Monochrome Screens

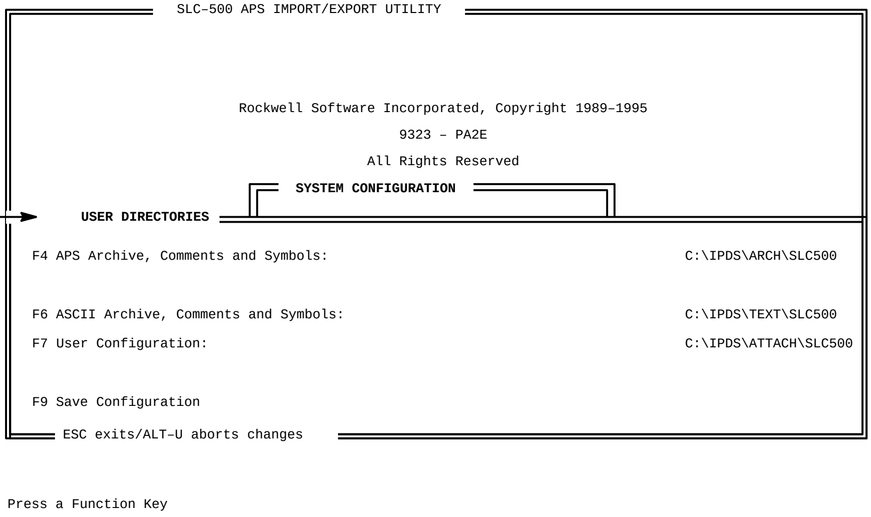
If you want to:	Press:	Then:
specify the user directories	**[F1**] – DEFINE DIR	see the following section, Specifying the User Directories.
choose between color or monochrome displays[1]	**[F3]** – COLOR SELECT	toggle between COLOR and MONOCHROME[2], then press [F9] – SAVE CONFIG or **[ESC]** after making your choice.
save the configuration permanently	**[F9**] – SAVE CONFIG	APSIE saves the configuration to the user preference file.

[1] You must have a color adaptor card and color monitor to use the color selection.

[2] Indicates the user preference default.

Specifying the User Directories

Below is the user directories screen. The directory paths shown are the default directories when the import/export utility is first run. The maximum number of characters in the pathname is 65. If there are more characters in the pathname than can fit in the window, the last 3 characters of the pathname are displayed as three periods (...), for example:
“C:\THIS\IS\A\LONG\PATHNAME\FOR\THE\WINDOW...”



```
                    SLC–500 APS IMPORT/EXPORT UTILITY


                    Rockwell Software Incorporated, Copyright 1989–1995
                                     9323 – PA2E
                                 All Rights Reserved
                         SYSTEM CONFIGURATION
    USER DIRECTORIES

 F4 APS Archive, Comments and Symbols:                    C:\IPDS\ARCH\SLC500


 F6 ASCII Archive, Comments and Symbols:                  C:\IPDS\TEXT\SLC500
 F7 User Configuration:                                   C:\IPDS\ATTACH\SLC500


 F9 Save Configuration
  ESC exits/ALT–U aborts changes


Press a Function Key
```

User Directories Window: These are the current directories that the import/export utility reads files from and writes files to.

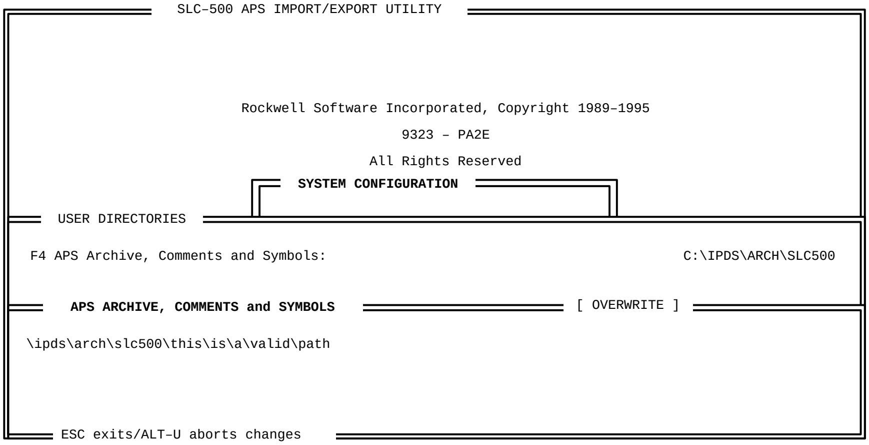
To enter a user directory, follow these steps:

1. Select the type of directory that you want to specify from table 2.B.

Table 2.B
Entering the User Directories

If you want to:	Press:	Then:
specify the directory where APS archive and documentation files are stored	**[F4]** – ARCHIVE DIR	the screen below is displayed.
specify the directory where ASCII archive and documentation files are stored	**[F6]** – ASCII DIR	the screen below is displayed.
specify the directory where the user preference file is stored	**[F7]** – CONFIG DIR	the screen below is displayed.
save the options displayed on this screen to the user preference file	**[F9]** – SAVE CONG	APSIE saves the configuration to the user preference file.

The text in the window varies depending on the function key pressed. For example, below is the "APS Archive, Comments and Symbols" window.



```
                    SLC-500 APS IMPORT/EXPORT UTILITY


                      Rockwell Software Incorporated, Copyright 1989-1995
                                          9323 - PA2E
                                      All Rights Reserved
                              SYSTEM CONFIGURATION
   USER DIRECTORIES

  F4 APS Archive, Comments and Symbols:                          C:\IPDS\ARCH\SLC500

    APS ARCHIVE, COMMENTS and SYMBOLS                    [ OVERWRITE ]
  \ipds\arch\slc500\this\is\a\valid\path


   ESC exits/ALT-U aborts changes
```

2. Enter the directory pathname. Press **`[INSERT]`** to toggle between overwrite and insert modes.

Overwrite mode – writes over and destroys text that may already exist.

Insert mode – writes new text without destroying the already existing text.

3. Press either:

`[ENTER]` or **`[ESC]`** – to save the drive and directory pathname and return to the previous display.

OR

`[ALT-U]` – to discard any changes that were made and return to the previous display.

After you press **`[ENTER]`**, **`[ESC]`** or **`[ALT-U]`**, the user directories screen is displayed. If you want to enter another user directory, return to the start of this section. If you want to save your configuration, press **`[F9]`**.

3 Importing ASCII Documentation/ Archive Files

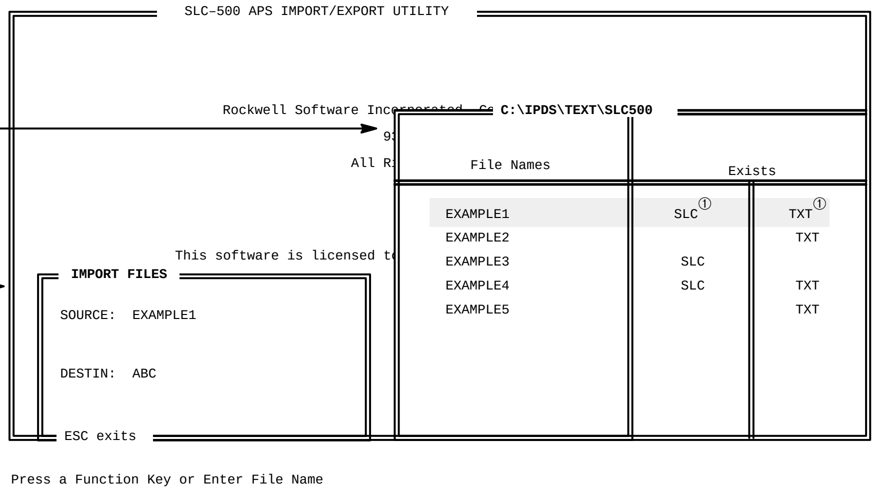
This chapter describes how to:

- configure the import utility
- import ASCII files
- examine the results of the import

At this point we assume that you have installed the APS/APSIE software and selected [F7] – IMPORT from the main menu. If not see chapter 1, Introducing the APS Import/Export Utility.

Configuring the Import Utility

After selecting [F7] – IMPORT from the main menu, the import screen is displayed.



```
SLC-500 APS IMPORT/EXPORT UTILITY

Rockwell Software Incorporated, Co  C:\IPDS\TEXT\SLC500
                              9
                          All Ri    File Names              Exists

                                    EXAMPLE1               SLC①      TXT①
                                    EXAMPLE2                          TXT
This software is licensed t         EXAMPLE3                SLC
 IMPORT FILES                       EXAMPLE4                SLC       TXT
                                    EXAMPLE5                          TXT
 SOURCE:  EXAMPLE1

 DESTIN:  ABC

 ESC exits

Press a Function Key or Enter File Name
```

DIR Window: Contains the names of all the ASCII source files that exist in the specified directory.

Import Files Window: Contains the names of the ASCII source file and the APS destination file selected.

① In the DIR window, notice the abbreviated words “SLC” and “TXT”: SLC indicates that an ASCII archive file exists; TXT indicates that an ASCII program documentation file exists for a particular filename. (The absence of one or the other means that it does not exist.)

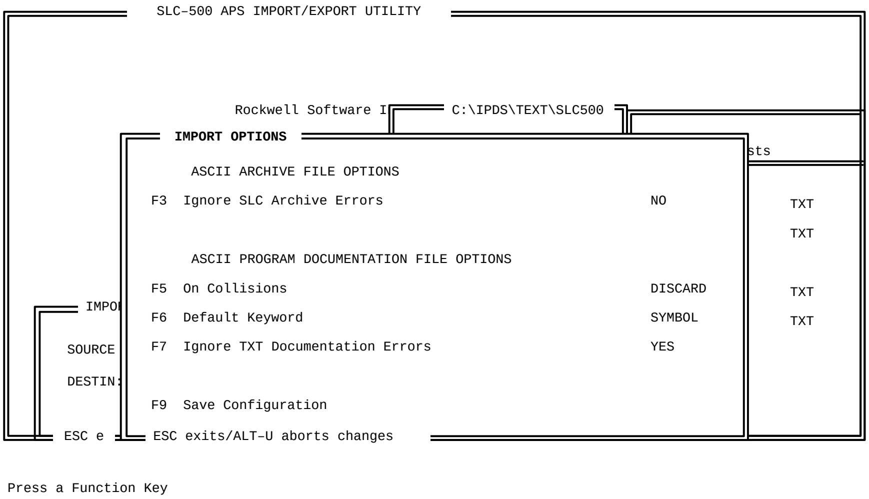
Select an import task to perform from table 3.A.

Table 3.A
Selecting an Import Task to Perform

If you want to:	Press:	Then:
define a directory	**[F1]** – DEFINE DIR	see chapter 2, Configuring the APS Import/Export Utility.
use as the import SOURCE file the name of the file that the cursor is on	**[F3**] – SELECT SOURCE	APSIE places the filename on the SOURCE line.
enter the name of the import destination file	**[F4**] – ENTER DESTIN	enter the destination file name or with DESTIN blank, press **`[ENTER]`** to use the same file name as SOURCE.
change the various options that control how the import process works	**[F5]** – SELECT OPTIONS	see the next section, Selecting Options.
import ASCII archive and documentation files	**[F7]** – IMPORT SLC & TXT	see the section, Importing ASCII Files.
import an ASCII archive file	**[F8]** – IMPORT SLC	see the section, Importing ASCII Files.
import an ASCII documentation file	**[F9]** – IMPORT TXT	see the section, Importing ASCII Files.
discard any changes that were made	the **`[ESC]`** key	APSIE discards any changes that were made and returns the previous display.

Selecting Import Options

After selecting [F5] – SELECT OPTIONS from the main import menu, the import/export utility displays the Import Options window.



```
                 SLC–500 APS IMPORT/EXPORT UTILITY



                           Rockwell Software I     C:\IPDS\TEXT\SLC500
                IMPORT OPTIONS
                                                                               sts
                     ASCII ARCHIVE FILE OPTIONS

                  F3  Ignore SLC Archive Errors                        NO        TXT

                                                                                 TXT
                     ASCII PROGRAM DOCUMENTATION FILE OPTIONS

                  F5  On Collisions                                    DISCARD   TXT
        IMPO
                  F6  Default Keyword                                  SYMBOL    TXT

      SOURCE      F7  Ignore TXT Documentation Errors                  YES

      DESTIN:

                  F9  Save Configuration

      ESC e       ESC exits/ALT–U aborts changes


Press a Function Key
```

This screen offers you options for configuring the import of both ASCII archive and documentation files. The function keys for this screen, with the exception of [F9] – SAVE CONFIG, toggle through all the possible values for a given option.

For example, the “Ignore TXT Documentation Errors” option: Function key [F7] – IGN TXT ERRORS toggles between the values “yes” and “no”, which are the only possible values for this option.

Note

APSIE can import online edit INSERT, REPLACE, and DELETE rungs. You can only create these rungs with an SLC 5/03 or SLC 5/04 processor. For more details on the use of these rungs, see the Advanced Programming Software User Manual.

Select import options from table 3.B.

Table 3.B
Selecting Import Options

If you want to:	Toggle:	Until the status is:
ignore any errors detected during the archive import process	**[F3]** – IGN SLC ERRORS	YES
abort the archive import process when any errors are detected		NO[1]
ignore any duplicate or conflicting entries in the imported ASCII documentation file	**[F5]** – ON COLLISION	DISCARD[1]
overwrite any duplicate or conflicting entries in the imported ASCII documentation file		OVERWRITE
choose the keyword that the import utility will use for any line in the ASCII documentation file without a keyword[3]	**[F6**] – DEFAULT KEYWORD	SYMBOL[1,2]
		ADDR. COMMENTS[2]
		INSTR. COMMENTS[2]
		RUNG COMMENTS[2]
ignore any errors detected during the documentation import process	**[F7**] – IGN TXT ERRORS	YES
abort the documentation import process when any errors are detected.		NO[1]
If you want to:	**Press:**	**Then:**
save the configuration permanently	**[F9**] – SAVE CONFIG	APSIE saves the configuration to the user preference file.
use this configuration for the session only	`[ENTER]` or `[ESC]`	APSIE accepts any changes that were made. Once APSIE is terminated, the changes are discarded.
discard any changes that were made	`[ALT-U]`	APSIE discards any changes that were made and returns the previous display.

[1] Indicates the user preference default.

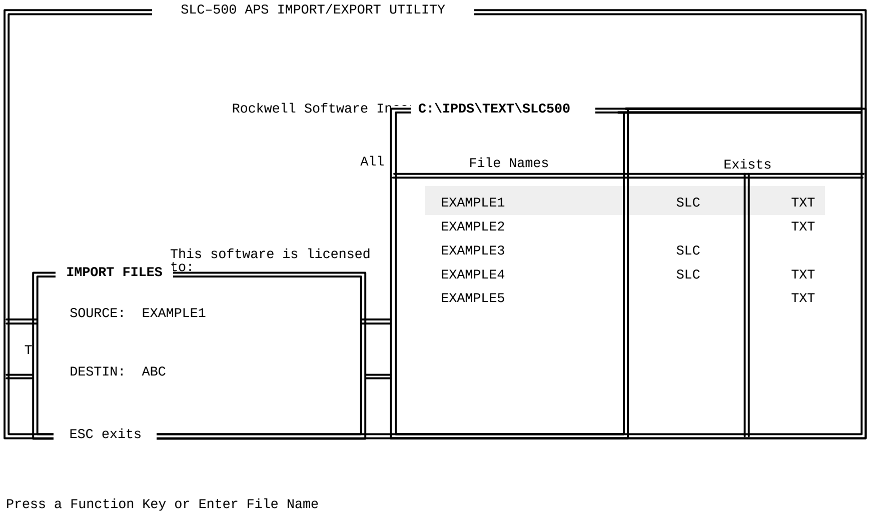
[2] You can choose only one of the four keywords as the default keyword.

[3] This only applies if you are not using keywords to group similar statements.

Importing ASCII Files

To import an ASCII file, follow these steps:

1. Start on the main import screen shown below.



```
                 SLC–500 APS IMPORT/EXPORT UTILITY

                  Rockwell Software In    C:\IPDS\TEXT\SLC500

                                  All       File Names                Exists

                                        EXAMPLE1             SLC           TXT
                                        EXAMPLE2                           TXT
              This software is licensed EXAMPLE3             SLC
      IMPORT FILES to:                  EXAMPLE4             SLC           TXT
                                        EXAMPLE5                           TXT
       SOURCE:  EXAMPLE1

  T

       DESTIN:  ABC


       ESC exits


Press a Function Key or Enter File Name
```

2. See table 3.C to perform the import.

Table 3.C
Importing ASCII Files

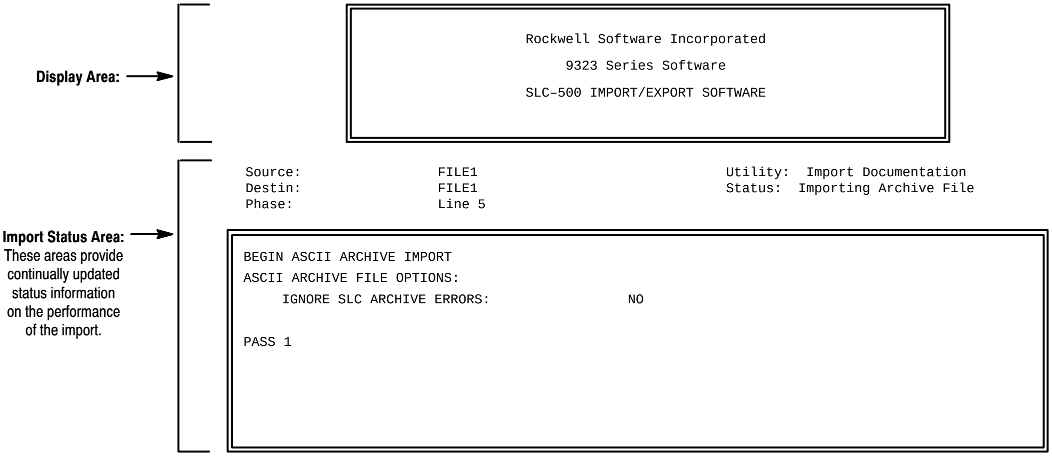
If you want to:	Then:
import ASCII archive & documentation files	**[F7]** – IMPORT SLC & TXT
import an ASCII archive file only	**[F8]** – IMPORT SLC
import an ASCII documentation file only	**[F9]** – IMPORT TXT
return to the main menu display	**[ESC]**

Note *If the processor type is incorrect you are immediately prompted: “Processor type missing or incorrect in .SLC file. Configure I/O?, You can:*

- *press **[F8] Yes** to reconfigure I/O*
- *press **[F10] No** to allow the import to continue (An archive file will not be created).*

To correct the I/O configuration, refer to the Advanced Programming Software User Manual. (APSIE uses the same I/O configuration function as APS.)

Once the import process starts, the following screen is displayed.



Display Area:

Import Status Area: These areas provide continually updated status information on the performance of the import.

```
                    Rockwell Software Incorporated

                        9323 Series Software

                    SLC–500 IMPORT/EXPORT SOFTWARE

Source:               FILE1                          Utility:  Import Documentation
Destin:               FILE1                          Status:  Importing Archive File
Phase:                Line 5

BEGIN ASCII ARCHIVE IMPORT
ASCII ARCHIVE FILE OPTIONS:
    IGNORE SLC ARCHIVE ERRORS:                NO

PASS 1
```

- *abort the import by pressing **[Control – C]***

The information in the bottom window of the import status area provides the same information that is stored in a log file. When the import is complete, you have the option of viewing the log file or returning to the previous screen.

Note *You cannot download the program to a processor immediately. You must first load the newly created APS archive file into APS and then save the file from the offline editor.*

Examining the Results of the Import

The log file provides the results of the import. It lists any errors that the utility encountered during the import process. For each error, it identifies the type of error and the location where the error was encountered in the ASCII file. "Illegal Addresses" and "Illegal Comments" are two examples of errors that you may encounter.

The default location for the log file is \IPDS\TEXT\SLC500. The log filename consists of the APSIE archive path, which you defined while configuring the import utility using **[F6] ASCII DIR**, the destination file name which you defined in the import utility using **[F4] ENTER DESTIN**, and the file extension .LOG.

APSIE also allows you to verify that a new archive file was created. The default location for the archive file is \IPDS\ARCH\SLC500. The archive filename consists of the destination filename and the file extension .ACH.

4 Exporting APS Documentation/ Archive Files

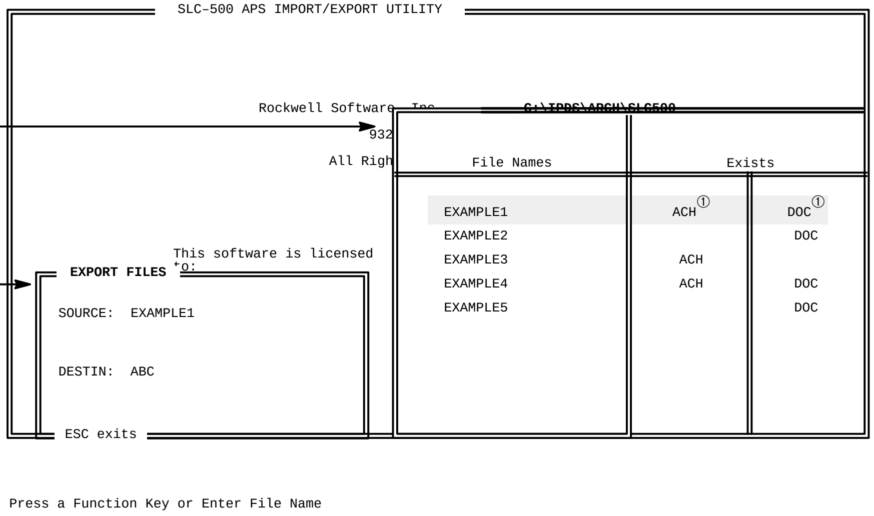
This chapter shows you how to:

- configure the export utility
- export APS files
- examine the results of the export

At this point we assume that you have installed the APS/APSIE software and selected [F8] – EXPORT from the main menu. If not, see chapter 1, Introducing the APS Import/Export Utility.

Configuring the Export Utility

After selecting [F8] – EXPORT from the main menu, the import/export utility displays the main export screen.



```
                SLC–500 APS IMPORT/EXPORT UTILITY

                         Rockwell Software  Inc        C:\IPDS\ARCH\SLC500
                                              932
                                        All Righ      File Names                Exists

                                                      EXAMPLE1           ACH①          DOC①
                                                      EXAMPLE2                           DOC
                   This software is licensed          EXAMPLE3             ACH
     EXPORT FILES  to:                                EXAMPLE4             ACH           DOC
                                                      EXAMPLE5                           DOC
   SOURCE:  EXAMPLE1


   DESTIN:  ABC


    ESC exits


Press a Function Key or Enter File Name
```

DIR Window: Contains the names of all the APS source files that exist in the specified directory.

Export Files Window: Contains the names of the APS source file and the ASCII destination file selected.

① In the DIR window, notice the abbreviated words “ACH” and “DOC”: ACH indicates that an APS archive file exists; DOC indicates that an APS program documentation file exists for a particular filename. (The absence of one or the other means that it does not exist.)

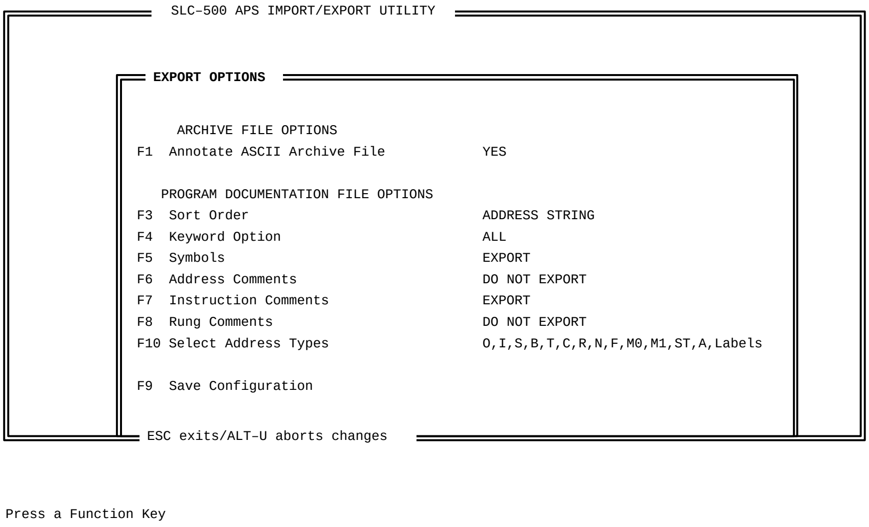
Select an export task to perform from table 4.A.

Table 4.A
Selecting an Export Task to Perform

If you want to:	Press:	Then:
define a directory	**[F1]** – DEFINE DIR	see Chapter 2, Configuring the User Directory.
use as the export SOURCE file the name of the file that the cursor is on	**[F3]** – SELECT SOURCE	APSIE places the filename on the SOURCE line.
enter the name of the export destination file	**[F4]** – ENTER DESTIN	enter the destination file name or with DESTIN blank, press **[ENTER]** to use the same file name as SOURCE.
change the various options that control how the export process works	**[F5]** – SELECT OPTIONS	see the next section, Selecting Options.
export APS archive and documentation files	**[F7]** – EXPORT ACH & DOC	see the section, Exporting APS Files.
export an APS archive file	**[F8]** – EXPORT ACH	see the section, Exporting APS Files.
export an APS documentation file	**[F9]** – EXPORT DOC	see the section, Exporting APS Files.
discard any changes made during the session	**[ESC]**	any changes made during the session are discarded and the previous display is returned.

Selecting Export Options

After selecting [F5] – SELECT OPTIONS from the main export menu, the import/export utility displays the Export Options window.



```
                    SLC–500 APS IMPORT/EXPORT UTILITY

              EXPORT OPTIONS

                 ARCHIVE FILE OPTIONS
             F1  Annotate ASCII Archive File            YES

               PROGRAM DOCUMENTATION FILE OPTIONS
             F3  Sort Order                             ADDRESS STRING
             F4  Keyword Option                         ALL
             F5  Symbols                                EXPORT
             F6  Address Comments                       DO NOT EXPORT
             F7  Instruction Comments                   EXPORT
             F8  Rung Comments                          DO NOT EXPORT
             F10 Select Address Types                   O,I,S,B,T,C,R,N,F,M0,M1,ST,A,Labels

             F9  Save Configuration

              ESC exits/ALT–U aborts changes


 Press a Function Key
```

This screen offers you options for configuring the export of both APS archive and documentation files. The function keys for this particular screen, with the exception of [F9] – SAVE CONFIG, toggle through all the possible values for a given option.

Take for example the ANNOTAT FILES option: function key [F1] – ANNOTAT FILES toggles between the values “yes” and “no”, which are the only possible values for this option. Select an export option from table 4.B.

Note

APSIE can export online edit INSERT, REPLACE, and DELETE rungs. You can only create these rungs with an SLC 5/03 or an SLC 5/04 processor. For more details on the use of these rungs, see the Advanced Programming Software User Manual.

Table 4.B
Selecting Export Options

If you want to:	Toggle:	Until the status is:
export the ASCII archive file with comments explaining the various sections, like processor type and data tables	**[F1]** – ANNOTAT FILE	YES[1]
export the ASCII archive file without comments explaining the various sections.		NO
sort by ascending order of the address value, as in: N7:0, N10:2, N10:10	**[F3]** – SORT ORDER	ADDRESS VALUE
sort by ascending order of the address string as in: N10:10, N10:2, N7:0		ADDRESS STRING[1]
sort into groups the comments in the ASCII documentation file in this order: symbols, address, instruction and then rung comments		KEYWORD
place all the keywords for symbols, rung, instruction, and address comments at the beginning of every statement in the ASCII documentation file	**[F4]** – KEYWORD OPTIONS	ALL[1][2]
place keywords at the beginning of groups with similar statements[3]		DEFAULT[2]
remove keywords from the ASCII documentation file		NONE[2]
export symbols	**[F5]** – SYMBOLS	EXPORT[1]
remove symbols from the ASCII documentation file		DO NOT EXPORT
export address comments	**[F6]** – ADDRESS COMMENTS	EXPORT[1]
remove address comments from the ASCII documentation file.		DO NOT EXPORT
export instruction comments	**[F7]** – INSTR COMMENTS	EXPORT[1]
remove instruction comments from the ASCII documentation file		DO NOT EXPORT

If you want to:	Toggle:	Until the status is:
export rung comments	**[F8]** – RUNG COMMENTS	EXPORT[1]
remove rung comments from the ASCII documentation file	**[F8]** – RUNG COMMENTS	DO NOT EXPORT
save the configuration permanently	**[F9]** – SAVE CONFIG	APSIE saves the configuration to the user preference file.
use this configuration for this session only	**[ENTER]** or **[ESC]**	APSIE accepts any changes that were made. Once APSIE is terminated, the changes are discarded.
discard any changes that were made	**[ALT–U]**	APSIE discards any changes that were made and returns the previous display.

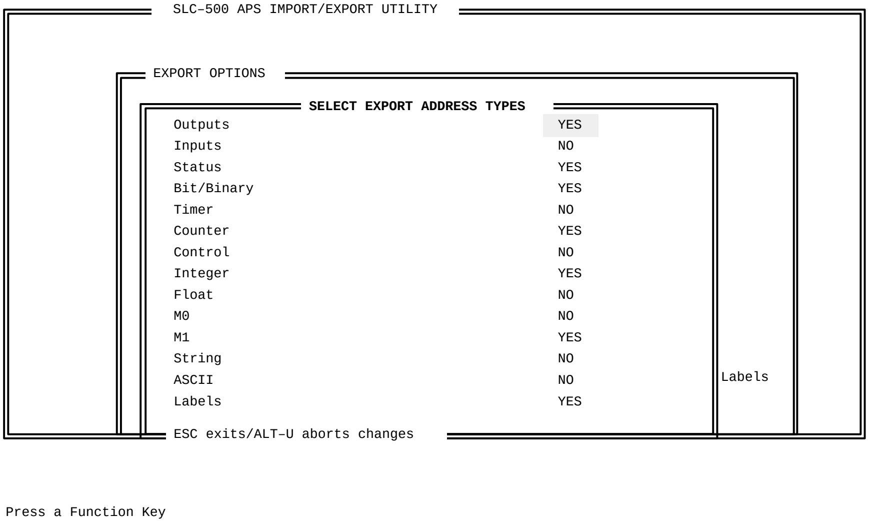
[1] Indicates the user preference default.

[2] You must specify “Sort by Keyword” on this screen, otherwise the default keywords do not appear in the exported file.

[3] You can choose only one keyword option as the keyword options default.

Selecting Export Address Types

After selecting [F10] – SELECT TYPES from the export options screen, APSIE displays the following window, labeled “Select Export Address Types.”



```
SLC–500 APS IMPORT/EXPORT UTILITY

          EXPORT OPTIONS
                    SELECT EXPORT ADDRESS TYPES
    Outputs                                         YES
    Inputs                                          NO
    Status                                          YES
    Bit/Binary                                      YES
    Timer                                           NO
    Counter                                         YES
    Control                                         NO
    Integer                                         YES
    Float                                           NO
    M0                                              NO
    M1                                              YES
    String                                          NO
    ASCII                                           NO                   Labels
    Labels                                          YES
    ESC exits/ALT–U aborts changes

Press a Function Key
```

From this screen you select which address types in the ASCII documentation file you want to export.

Use the up– and down–arrow cursor keys to move through the address types displayed in the window, highlighting those types you wish to change.

Tables 4.C and 4.D provide you with two options for configuring the address types: table 4.C explains how you can change the status of each address type one at a time; table 4.D explains how you can configure the export utility so that all or none of the address types are exported.

Note

After you have configured the address types, you can save the configuration permanently by pressing [F9] – SAVE CONFIG from the Export Options window. (Press **[ENTER]** *or* **[ESC]** *to save the configuration for this session only.)*

Table 4.C

Selecting the Export Address Types Individually

If you want to:	Toggle:	Until the status is:
export *all* of the program documentation for addresses of the type that you have highlighted.	**[F1]** – TOGGLE ENTRY	YES
export *none* of the program documentation for addresses of the type that you have highlighted.		NO
If you want to:	**Press:**	**Then:**
use this configuration for the session only	`[ENTER]` or `[ESC]`	APSIE accepts any changes that were made. Once APSIE is terminated, the changes are discarded.
discard any changes that were made	`[ALT–U]`	APSIE discards any changes that were made and returns the previous display.

Table 4.D

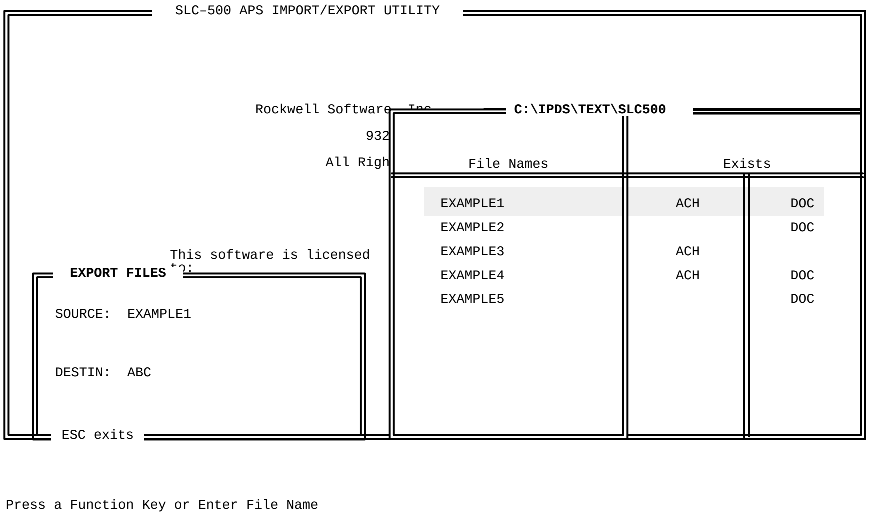
Selecting All or None of the Export Address Types

If you want to:	Press:
export *all* of the program documentation for all address types.	**[F2]** – ALL YES
export *none* of the program documentation for any address type.	**[F3]** – ALL NO
use this configuration for the session only and return to the previous display	`[ENTER]` or `[ESC]`
discard any changes that were made and return to the previous display	`[ALT–U]`

Exporting APS Files

To export an APS file, follow these steps:

1. Start from the main export display shown below.

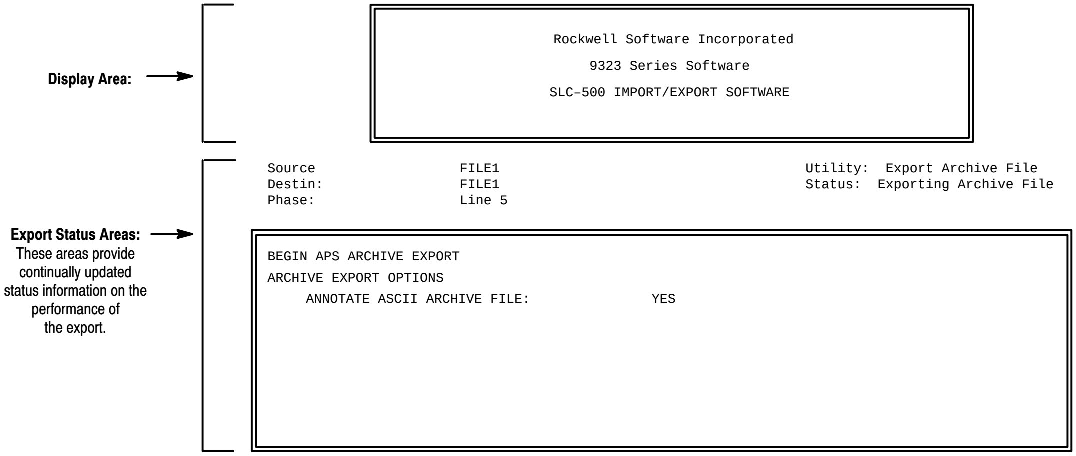


```
                 SLC–500 APS IMPORT/EXPORT UTILITY

                     Rockwell Software  Inc     C:\IPDS\TEXT\SLC500
                                   932
                              All Righ     File Names               Exists

                                          EXAMPLE1          ACH          DOC
                                          EXAMPLE2                       DOC
                This software is licensed EXAMPLE3          ACH
   EXPORT FILES to:                       EXAMPLE4          ACH          DOC
                                          EXAMPLE5                       DOC
  SOURCE:  EXAMPLE1


  DESTIN:  ABC


   ESC exits


Press a Function Key or Enter File Name
```

2. See the table below to perform the export.

If you want to:	Press:
export APS archive & documentation files	**[F7]** – EXPORT ACH & DOC
export an APS archive file only	**[F8]** – EXPORT ACH
export an APS documentation file only	**[F9]** – EXPORT DOC
return to the main menu	**[ESC]**

After the export process begins the screen below is displayed.



Display Area:

```
                  Rockwell Software Incorporated
                       9323 Series Software
                  SLC-500 IMPORT/EXPORT SOFTWARE
```

Export Status Areas: These areas provide continually updated status information on the performance of the export.

```
Source            FILE1                          Utility:  Export Archive File
Destin:           FILE1                          Status:  Exporting Archive File
Phase:            Line 5

BEGIN APS ARCHIVE EXPORT
ARCHIVE EXPORT OPTIONS
    ANNOTATE ASCII ARCHIVE FILE:            YES
```

The information in the bottom window of the export status area provides the same information that is stored in the log file. When the export is complete, you have the option of either viewing the log file or returning to the previous screen.

Examining the Results of the Export

The log file provides the results of the export. It lists any errors that the utility encountered during the export process. For each error, it identifies the type of error and the location where the error was encountered in the ASCII file. “Illegal Addresses” and “Illegal Comments” are two examples of errors that you may encounter.

The default location for the log file is \IPDS\TEXT\SLC500. The log filename consists of the APSIE archive path, which you defined while configuring the export utility using **`[F6] ASCII DIR`**, the destination file name which you defined in the export utility using **`[F4] ENTER DESTIN`**, and the file extension .LOG.

APSIE also allows you to verify that a new text file was created. The text filename consists of the destination filename and the file extension .TXT.

5 Creating an ASCII Archive File

This chapter shows you how to create your own SLC 500 program in ASCII archive file format. You can use these programs with the import utility. This chapter consists of the following sections:

- explaining keywords, operands, and comments
- specifying ASCII archive files
- protecting archive files
- examining ASCII archive files

So that you may better understand and see the relationship between APS and ASCII programming languages, example APS ladder programs are included with the example ASCII programs.

Explaining Keywords, Operands, and Comments

Each section of the ASCII archive file usually consists of keywords, operands, and comments.

Keywords

Keywords include symbols and ladder instruction mnemonics. Table 5.A explains the location of each keyword in the ASCII archive file.

Table 5.A
Defining Keywords

This Keyword	Precedes
START	the start of an ASCII file.
RACK	the definition of an expansion chassis. (does not apply to MicroLogix 1000 controllers)
SLOT	the definition of an I/O module. (does not apply to MicroLogix 1000 controllers) These keywords are used in conjunction with SLOT (SLC 5/02, SLC 5/03, and SLC 5/04 processors only) ● SCAN_IN Number of scanned inputs. ● SCAN_OUT Number of scanned outputs. ● M1_SIZE Number of M1 data file words. ● M0_SIZE Number of M0 data file words. ● ISR Interrupt service routine file number. ● G_FILE Data for G–file.
DATA	the definition of a data table file.
PROJECT	the project name and ladder filenames.
LADDER	the definition of a ladder file.
FORCE	the definition of a force table.
CHAN_CONFIG	the definition of a channel configuration file. (SLC 5/03 and SLC 5/04 processors only)
INPUT_FILTERS	the definition of an input filter file. (MicroLogix 1000 controllers only)
MULTIPOINT	the definition of an I/O list. (SLC 5/03 OS302, SLC 5/04 OS401, and MicroLogix 1000 controllers only)

The SLC 5/03 and SLC 5/04 processors have three keywords that indicate that a file is protected. See table 5.B.

Table 5.B
Defining Keywords for SLC 5/03 and SLC 5/04 Processors

This Keyword	Indicates
PROTECT_DATA	the type of DATA file protection applied to the specified file(s). The following keywords are used in conjunction with PROTECT_DATA: ● CONSTANT Data file cannot be changed by the user or user program during program operation. ● STATIC Data file can only be changed by the user program during program operation. ● MEM_MOD Protects individual data files from changes during memory module transfers if the programs match and are valid.
PROTECT_LAD	the LADDER file(s) specified are protected.
PROTECT_FORCE	that all FORCE file(s) are protected.

Operands

Operands are either *logical addresses* or *immediate values*. You can enter the logical addresses in any valid format. The import utility generates the complete address format. You may enter the immediate values in decimal, hex, octal, or binary formats. See table 5.C.

Table 5.C
Defining Immediate Values

Format:	Description:	Example:
decimal	a number with an optional plus or minus sign and decimal digits.	–32768
hex	a number that starts with a zero, followed by an "X", then any four characters from 0–9 or A–F.	OXFA90
octal	a number that starts with a zero, followed by an "O", then any six digits from 0 to 7.	0O370010
binary	a number that starts with a zero, followed by a "B", then up to 16 zeros or ones.	0B010110
floating point	a number with an optional plus or minus sign that falls in the range of 3.402823×10^{38} to $1.1754944 \times 10^{-38}$ or 0.0	–32768.00

Comments

You can add comments anywhere in the ASCII archive file when you create it.

To add a single line comment, place the comment after an exclamation mark (!). In this case, the import utility ignores all text from the exclamation mark to the end of the line.

You may also enter comments in the ASCII archive file by inserting the comment between two percent signs. (Tabs, carriage returns or spaces before and after the percent signs are optional.) For example: % This is a comment %. You may include one or more carriage returns in a comment of this type.

Enter comments on a single line or several lines by themselves, or directly following a complete ASCII command. If the import utility encounters a comment character (% or !) between two quotation marks (“”), it considers the comment character as part of the quoted string.

The following example shows you how comments may look in your import file. Notice that the comments used to document ASCII files only describe those files. The import utility does not store these comments in the database.

```
!This is an example of a single–line comment.
Project 1747–L511 % 1747–L511 IK Modular CPU %
LADDER 2
SOR         !Rung 0 of File 2
XIC B3/0 OTL B3/1 EOR
SOR XIC B3/1 TON T4:0 0.01 1000 0 EOR % Timer 0 %
```

Specifying ASCII Archive Files

When specifying an ASCII archive file, be aware of the following guidelines:

- To create the file, use a text editor that produces only printable ASCII characters, with no control or hidden characters.
- Do not use graphics characters.

The ASCII archive file is made up of six sections for MicroLogix 1000 controllers, six sections for SLC 5/01 and SLC 5/02 processors, and seven sections for SLC 5/03 and SLC 5/04 processors. These sections are shown in table 5.D.

Of these sections, you must arrange three of them, the program header, chassis configuration, and module configuration (bold in table 5.D) in the order shown in table 5.D. In general, you can enter the remaining sections in any order, beginning with the data table section.

Note

The order in which you enter the program files section and the data table section is important if your program files contain instructions that use data table files to store control information. (For example, the MSG instruction uses a data table file to store information such as the node number, message length, and file number.) For such cases, see the table below:

If you enter the	after you enter the	be careful not to overwrite the existing
data table section	program files section	control information with new data table information.
program files section	data table section	data table values with instruction control information.

Table 5.D
ASCII Archive File

Program Header
Chassis Configuration (does not apply to MicroLogix 1000 controllers)
Module Configuration (does not apply to MicroLogix 1000 controllers)
Project Name
Program Files File 2 : File n
Data Table
Channel Configuration Data List (SLC 5/03 and SLC 5/04 processore only)
Adjustable Input Filters (MicroLogix 1000 controllers only)
Multi–Point I/O List (SLC 5/03 OS302, SLC 5/04 OS401 processors, and MicroLogix 1000 controllers only)

Specifying the Program Header

The program header defines the target processor for the import utility. You must provide information for this section of the archive file. (You could leave any of the other six sections empty.)

The program header format for fixed and modular controllers consists of the keyword “START” and the controller catalog number. Do not enter the catalog number with tabs or spaces. For “other” fixed controllers the program header format consists of the keyword “START”, “OTHER–1K” and the processor ID. See table 5.E.

Table 5.E
Program Header Formats and Examples

Program Header Format:	Example Program Header:
START *Controller_catalog_number*	START 1747–L20A
START *Other–1K Processor_ID*	START OTHER–1K 1920

The available controllers include 20, 30, and 40 I/O fixed controllers, as well as 3 different modular processors. Input, output and line power information in the tables is for reference only. See tables 5.F, G, H, I, and J.

If you use a fixed processor not specified in tables 5.F, G, or H, you must use the processor name “OTHER–1K” (undefined fixed controller with 1K of memory). The processor ID refers to the ID code specified in the user manual for your processor.

Table 5.F
20 I/O Fixed Controller

Controller Catalog Number:	Inputs:	Outputs:	Line Power:
1747–L20A	12–120V ac	8–Relay	120/240V ac
1747–L20B	12–120V ac	8–Triac	120/240V ac
1747–L20C	12–dc Sink	8–Relay	120/240V ac
1747–L20D	12–dc Sink	8–Triac	120/240V ac
1747–L20E	12–dc Sink	8–Transistor	120/240V ac
1747–L20F	12–dc Sink	8–Relay	24V dc
1747–L20G	12–dc Sink	8–Transistor	24V dc
1747–L20L	12–dc Source	8–Transistor	24V dc
1747–L20N	12–dc Source	8–Transistor	24V dc
1747–L20P	12–240V ac	8–Triac	120/240V ac
1747–L20R	12–240V ac	8–Relay	120/240V ac

Table 5.G
30 I/O Fixed Controllers

Controller Catalog Number:	Inputs:	Outputs:	Line Power:
1747–L30A	18–120V ac	12–Relay	120/240V ac
1747–L30B	18–120V ac	12–Triac	120/240V ac
1747–L30C	18–dc Sink	12–Relay	120/240V ac
1747–L30D	18–dc Sink	12–Triac	120/240V ac
1747–L30L	18–dc Source	12–Transistor	120/240V ac
1747–L30P	18–240V ac	12–Triac	120/240V ac

Table 5.H
40 I/O Fixed Controllers

Controller Catalog Number:	Inputs:	Outputs:	Line Power:
1747–L40A	24–120V ac	16–Relay	120/240V ac
1747–L40B	24–120V ac	16–Triac	120/240V ac
1747–L40C	24–dc Sink	16–Relay	120/240V ac
1747–L40E	24–dc Sink	16–Transistor	120/240V ac
1747–L40F	24–dc Sink	16–Relay	24V dc
1747–L40L	24–dc Source	16–Transistor	120/240V ac
1747–L40P	24–240V ac	16–Triac	120/240V ac

Table 5.I
Modular Processors

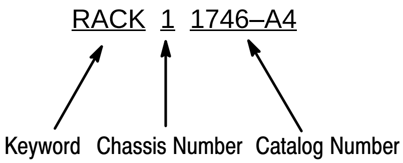
Controller Catalog Number:	Type:
1747–L511	SLC 5/01 1K User Memory
1747–L514	SLC 5/01 4K User Memory
1747–L524	SLC 5/02 4K User Memory
1747–L532	SLC 5/03 OS300 12K User Memory
1747–L532	SLC 5/03 OS301 12K User Memory
1747–L532	SLC 5/03 OS302 12K User Memory
1747–L541	SLC 5/04 OS401 12K User Memory
1747–L542	SLC 5/04 OS400 20K User Memory
1747–L542	SLC 5/04 OS401 28K User Memory
1747–L543	SLC5/04 OS401 60K User Memory

Table 5.J
MicroLogix 1000 Controllers

Controller Catalog Number:	Inputs:	Outputs:	Line Power:
1761-L16AWA	10 pt. ac	6-Relay	120/240V ac
1761-L32AWA	20 pt. ac	12-Relay	120/240V ac
1761-L16BWA	10 pt. ac	6-Relay	120/240V ac
1761-L32BWA	20 pt. ac	12-Relay	120/240V ac
1761-L16BWB	10 pt. dc	6-Relay	120/240V ac
1761-L32BWB	20 pt. dc	12-Relay	120/240V ac
1761-L16BBB	10 pt. dc	4-FET and 2-Relay	120/240V ac
1761-L32BBB	20 pt. dc	10-FET and 2-Relay	120/240V ac
1761-L32AAA	20 pt. ac	10-Triac and 2-Relay	120/240V ac

Configuring the Chassis (Does Not Apply to MicroLogix 1000 Controllers)

The chassis configuration format consists of the keyword “RACK”, the *chassis number* and *catalog number.* Use this format for each expansion chassis that you have. For example:

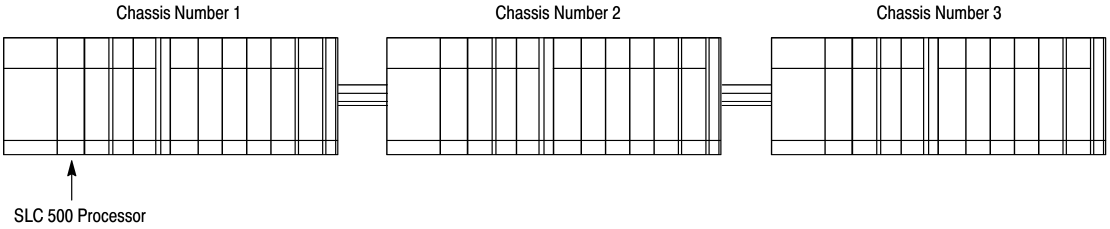


```
RACK 1 1746–A4
```

Specifying the Chassis Number

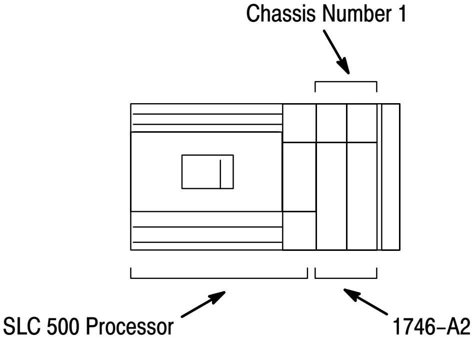
The chassis number is the location of the expansion chassis in the I/O configuration. An SLC 500 modular processor can use up to three chassis. The chassis containing the processor is always chassis number 1. If you have more than one chassis, number the chassis that follow number 2 and number 3. The chassis numbers must be specified in order; that is, specify chassis 1 before specifying chassis 2. (3 is the largest valid chassis number for modular style hardware.)

SLC 500 Modular Controller



The SLC 500 fixed controller has only one chassis. Therefore, always enter 1 for the chassis number when using a fixed processor with a 2–slot (1746–A2) expansion chassis.

SLC 500 Fixed Controller



Specifying the Chassis Catalog Number

The chassis catalog number defines the type of expansion chassis. When you enter the catalog number, do not use tabs or spaces between the numbers and letters.

If you enter an invalid catalog or chassis number, the import utility ignores the chassis configuration section of the ASCII archive file and displays an error message, which is written to the log file. Table 5.K lists the catalog numbers for the available chassis. (The information concerning chassis description and type of hardware style required is provided for reference only.)

Table 5.K
Available Expansion Chassis

Catalog Number :	Chassis Description:	Type of Hardware Style Required (Modular/Fixed):
1746–A2	2–slot Backplane	Fixed
1746–A4	4–slot Backplane	Modular
1746–A7	7–slot Backplane	Modular
1746–A10	10–slot Backplane	Modular
1746–A13	13–slot Backplane	Modular

Configuring the I/O Slots (Does Not Apply to MicroLogix 1000 Controllers)

There are three formats that you can use to define the I/O slot configuration. The format that you use depends on your module. See table 5.L.

Table 5.L
Determining which I/O Slot Format to Use

If your module:	**Use the following I/O Slot Format (Core Elements):**	**Use these optional arguments with the core elements for Modular Controllers only:**
is listed in Table 5.M	**(Format 1)** SLOT *Slot_number Catalog_number*	*SCAN_IN x* *SCAN_OUT x* *M0_SIZE x* *M1_SIZE x* *ISR x* *G FILE g_file_size* *g_file_data . . .* (See Table 5.N for greater detail on the optional arguments.)
is ***not*** included in Table 5.M and the module ID number is *not* 63xx, 95xx, 127xx, 159xx, 199xx, 223xx, or 255xx	**(Formal 2)** SLOT *Slot_number Module_ID*	
is ***not*** included in Table 5.M and the module ID *is* 63xx, 95xx, 127xx, 159xx, 199xx, 223xx, or 255xx	**(Format 3)** SLOT *Slot_number* *Extended_module_ID Max_input* *Max_output*	

Table 5.M
Available Modules for SLC 500[1]

Description of Available Modules:	Catalog Number:
4–input 100/120V ac	1746–IA4
8–input 100/120V ac	1746–IA8
16–input 100/120V ac	1746–IA16
4–input 200/240V ac	1746–IM4
8–input 200/240V ac	1746–IM8
16–input 200/240V ac	1746–IM16
8–output (TRIAC) 100/240V ac	1746–OA8
16–output (TRIAC) 100/240V ac	1746–OA16
8–input (SINK) 24V dc	1746–IB8
16–input (SINK) 24V dc	1746–IB16
32–Input (SINK) 24V dc	1746–IB32
16–input [TTL](SOURCE) 5V dc	1746–IG16
8–input (SOURCE) 24V dc	1746–IV8
16–input (SOURCE) 24V dc	1746–IV16
32–Input (SOURCE) 24V dc	1746–IV32
8–output [TRANS](SOURCE) 10/50V dc	1746–OB8
16–output [TRANS](SOURCE) 10/50V dc	1746–OB16
32–Output [TRANS](SOURCE) 10/50V dc	1746–OB32
8–output [TRANS](SINK) 10/50V dc	1746–OV8
16–output [TRANS](SINK) 10/50V dc	1746–OV16
32–Output [TRANS](SINK) 10/50V dc	1746–OV32
16–output [TTL](SINK) 5V dc	1746–OG16
4–output [RLY] 240V ac	1746–OW4
8–output [RLY] 240V ac	1746–OW8
16–output [RLY] 240V ac	1746–OW16
2–input 100/120V ac 2–Output [RLY]	1746–IO4
4–input 100/120V ac 4–Output [RLY]	1746–IO8
6–input 100/120V ac –4– 6–Output [RLY]	1746–IO12
Node Adaptor Module (1/4 Chassis)	1747–DCM–1/4
Node Adaptor Module (1/2 Chassis)	1747–DCM–1/2
Node Adaptor Module (3/4 Chassis)	1747–DCM–3/4
Node Adaptor Module (Full Chassis)	1747–DCM–FULL
4 Channel Analog Input	1746–NI4
Analog Combination 2 In & 2 Current Out	1746–NIO4I

[1] Table 5.M continues on to the next page.

Table 5.M
Available Modules for SLC 500 (continued)

Description of Available Modules:	Catalog Number:
Fast Analog Combination 2 In & 2 Current Out	1746–FIO4I
Analog Combination 2 In & 2 Voltage Out	1746–NIO4V
Fast Analog Combination 2 In & 2 Voltage Out	1746–FIO4V
4 Channel Analog Current Output	1746–NO4I
4 Channel Analog Voltage Output	1746–NO4V
Single Axis Motion Controller	1747–HS
Remote I/O Scanner	1747–SN
Distributed I/O Scanner (7 blocks)	1747–DSN–7BLK
Distributed I/O Scanner (30 blocks)	1747–DSN–30BLK
High Speed Counter/Encoder Module	1746–HSCE
BASIC Module (SLC 5/01)	1746–BAS–5/01
BASIC Module (SLC 5/02)	1746–BAS–5/02
16–input 24V ac/dc	1746–IN16
8–Output Isolated Relay V ac/dc	1746–OX8
Any 8–pt Discrete Input Module	1746–I*8
Any 16–pt Discrete Input Module	1746–I*16
Any 32–pt Discrete Input Module	1746–I*32
Any 8–pt Discrete Output Module	1746–O*8
Any 16–pt Discrete Output Module	1746–O*16
Any 32–pt Discrete Output Module	1746–O*32
16–Input [FAST](SINK) 24V dc	1746–ITB16
High Current 120/240V ac Output Card	1746–OAP12
16–Input [FAST](SOURCE) 24V dc	1746–ITV16
4 Channel RTD/Resistance Module	1746–NR4
4 Channel Thermocouple Input Module	1746–NT4
16–Output [TRANS 1 AMP](SOURCE) 24V dc	1746–OBP16
16–Output [TRANS 1 AMP](SINK) 24V dc	1746–OVP16
Stepper Controller Module	1746–HSTP1
Device Net Scaner Module	1747–SDN
DH–485/RS–232C Interface Module (Series A)	1747–KEA
DH–485/RS–232C Interface Module (Series B)	1747–KEB

Table 5.N lists the optional arguments for 1746–L524, –L532, –L541, and –L542 modular controllers only.

Table 5.N
Optional Arguments
(For 1746–L524, –L532, –541, and –L542 modular controllers only)

Optional Arguments:	Use these integers with the optional argument:	These integers specify:
SCAN_IN	(0 – 32)[1]	how many words of input the I/O scan updates.
SCAN_OUT	(0 – 32)[1]	how many words of output the I/O scan updates.
M0_SIZE	(0 – 32768)	the size, in words, of the M0 file. The sum of Input, Output, G file, M0 and M1 file sizes must not exceed 32768 words.
M1_SIZE	(0 – 32768)	the size, in words, of the M1 file. The sum of Input, Output, G file, M0 and M1 file sizes must not exceed 32768 words.
ISR	(0, 3 – 255)[2]	a subroutine file number.
G_FILE	(0 – 255)[3]	the number of words that the import utility allocates for the G file. (See Table 5.O for example G–file arguments.)

[1] Make sure that the integer specified is less than or equal to the number of output words allowed for the module specified by module ID, extended module ID, or catalog number.

[2] A subroutine file number of zero prevents a subroutine from being executed if the module in the defined slot generates an I/O interrupt.

[3] Word 0 of the G file must equal 0. When the G file is viewed in APS, the first word will *not* be 0.

Table 5.O provides two example G–file arguments.

Table 5.O
Example G–File Arguments

G–File Format:	This example G–File argument:	Creates a G file with:	See the following screen:
G_*FILE Value_List*	SLOT 1 12385 **G_FILE 10**	10 elements, all = 0	1
G_*FILE Value_List*	SLOT 2 12385 **G_FILES 5 0 2 3 4 5**	5 elements: 0 = 0, 1 = 2, etc.	2

The following screens show you how the APS G–file monitor displays the G–file examples in table 5.O.

Screen 1

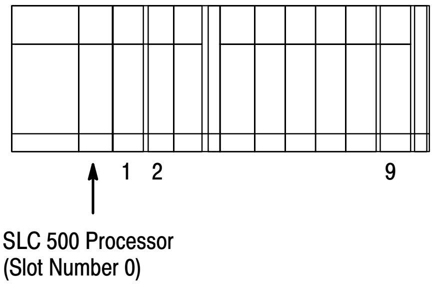
```
Address  0 1 2  3  4  5  6  7  8  9
G1:0     0 0 0  0  0  0  0  0  0  0
```

Screen 2

```
Address  0 1 2  3  4  5  6  7  8  9
G2:0     0 2 3  4  5
```

The common elements in the three formats are the keyword “SLOT” and the *slot number.* The slot number defines the location of the module. The first slot of the first chassis, slot 0, always contains the CPU module. The largest possible slot number for fixed style hardware is 2; for modular style hardware it is 30. Determine the number of configurable slots by the number and types of chassis used. See figure 5.1.

Figure 5.1
Determining the Slot Number of a 10–Slot Chassis (1747–A10)



To complete the I/O slot configuration, use one of the three formats specified in table 5.L. See table 5.P for examples of the I/O slot configuration formats.

Table 5.P
Example I/O Slot Configuration Formats

Format:	Example of Format:
1	SLOT 1 1746–IM8
2	SLOT 2 15535 SCAN_IN 0 SCAN_OUT 10 M1_SIZE 400 M0_SIZE 800 ISR 6 G_FILE 5 0x0000 0x0010 0xfff 0x2383 0x7823
3	SLOT 3 15900 32 5 SCAN IN 12 SCAN OUT 2 ISR 5

Configuring the Data Table Lists

The data table lists define the SLC 500 data table. There are two ways that addresses are defined. You can:

- let the import utility define the file type and largest address when the data table is empty

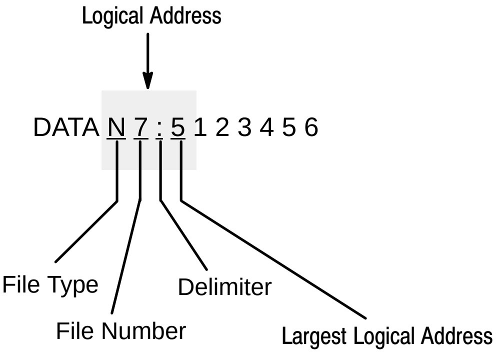
  OR

- enter the data table and describe each data file. This section will help you accomplish this task.

The data table is the list of data files that the processor uses. The data file format consists of the keyword DATA and a logical address or logical file. Logical addresses and files may also be entered with a value list.

Defining the Logical Address

The logical address consists of the file type, file number, a delimiter (a colon or semicolon) and the largest logical address. For example:



Data File Addressing

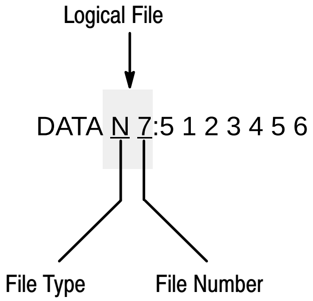
If you precede the logical address with three periods (...), the import utility places the data contained in the value list into the data file starting at the logical address. Otherwise, the import utility places the data contained in the value list into the data file starting at word 0. The import utility determines the correct size for the file based on the number of data elements in the value list.

String File Addressing

When defining a String (ST) file address, you *must* precede the file type with three periods (such as DATA ...ST#:# where the #s are the file number and element number [respectively], ranging from ST9:0–ST9:255 through ST255:0–ST255:255).

Defining the Logical File

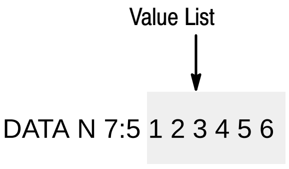
The logical file consists of only the file type and data file number. For example:



If you supply only the file type and number (a logical file), the import utility calculates the correct data table size for the file.

Defining the Value List

The value list defines the initial values for the data table file. You can leave the value list empty or supply immediate values. See the example below; it shows a value list with immediate values.



If you leave the value list empty, the import utility creates the data table specified by the logical address. The import utility then initializes the data file with zeros. For example, the data file “DATA N10:5” would create data table N10 and allocate six words of data with zeros for data values.

The import utility adjusts the size of the data table to fit all data table values. You can enter initial data values using binary, decimal, hex, or octal format. (Enter formats in upper or lower case letters.)

Important Notes on Data Table Files

Read these notes before entering the data table files.

- *Input* and *output* data tables are initialized one slot at a time. Therefore, the I/O configuration, not the value list, determines the data table size for output and input files.
- The data table files of a MicroLogix 1000 controller are fixed in type and size. You can use the value list only to initialize or alter the data values of a MicroLogix 1000 controller.
- You cannot provide initializing data for M0 and M1 files.
- The processor type determines the size of the Status file (S2). The fixed controllers and SLC 5/01 processors have 16 elements, the SLC 5/02 processors and MicroLogix 1000 controllers have 33 elements, the SLC 5/03 processors have 83 elements, the SLC 5/04 OS400 processors have 87 elements, and the SLC 5/04 OS401 processors have 164 elements. The value list does not alter the data table size of the Status file (S2). There is no range checking done of Status file values.
- You can enter a logical address to the element level only. The import utility ignores subelement and bit addresses. See table 5.Q for an example of valid and invalid logical addresses.

Table 5.Q
Valid and Invalid Logical Addresses

Valid Logical Addresses:	Invalid Logical Addresses:
T4:10	T4:10.PRE
T4:0	T4:0.ACC/10
I1:0	I1:0.3/10

To define the data file, follow these steps:

1. Enter the keyword DATA.

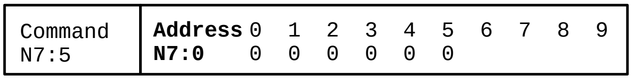
2. Complete the data file using the data file formats shown in table 5.R.

Table 5.R
Data File Formats and Examples

Data File Format:	Examples of Data File Entries:	The Example Data File Entry Creates:	See the following screen:
DATA *logical_address*	DATA N7:5	n7:0–5, initializes all to zero	1
DATA *logical_file*	DATA N7	n7:0, n7:0 = 0	2
DATA *Logical_address Value_list*	DATA N7:5 1 2 3 4 5	n7:0–5, n7:0 = 1, n7:1 = 2, etc.	3
DATA *Logical_file Value_list*	DATA N7 1 2 3 4 5	n7:0–4, n7:0 = 1, n7:1 = 2, etc.	4
DATA *. . . Logical_address Value_list*	DATA . . . N7:5 5 6	n7:0–6, n7:0–4 = 0, n7:5 = 5, 6 = 6	5

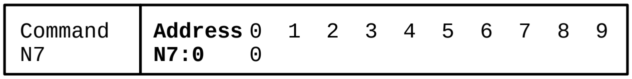
The following screens show you how the APS data monitor displays the data file examples in table 5.R.

Screen 1



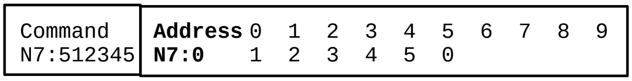
```
Command   Address 0  1  2  3  4  5  6  7  8  9
N7:5      N7:0    0  0  0  0  0  0
```

Screen 2



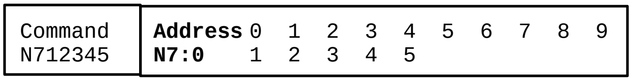
```
Command   Address 0  1  2  3  4  5  6  7  8  9
N7        N7:0    0
```

Screen 3



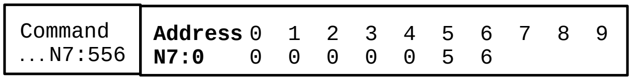
```
Command   Address 0  1  2  3  4  5  6  7  8  9
N7:512345 N7:0    1  2  3  4  5  0
```

Screen 4



```
Command   Address 0  1  2  3  4  5  6  7  8  9
N712345   N7:0    1  2  3  4  5
```

Screen 5



```
Command   Address 0  1  2  3  4  5  6  7  8  9
...N7:556 N7:0    0  0  0  0  0  5  6
```

Example Data Files

The following examples show initial data values in decimal, hex and octal formats. The comments between the percent signs (%) explain each of the formats.

```
   DATA N7:16  !Initial Data Values in Decimal Format

% The import utility allocates data elements N7:0 to N7:16, which are
initialized to zero if they do not exist %
% The import utility places 5249 into the data file at address N7:16 %
% The import utility places 110 into the data file at address N7:31 %

         5249  0  549 0    0  0  0  1  0  0
         –16   0  81   0    0  110
```

```
   DATA N7:37  !Initial Data Values in Hex Format

% The import utility allocates data elements N7:0 to N7:37, which are
initialized to zero if they do not exist %
% The import utility places 0X1111 into the data file at address N7:0 %
% The import utility places 0X2323 into the data file at address N7:31 %

         0X1111  0X0000  0X0000  0X0000  0X0000  0X0000  0X0000
         0X0000  0X0000
         0X0000  0X0000  0X0000  0X0000  0X0000  0X0000  0X0000
         0X0000  0X0000
```

```
   DATA I:1    !Initial Data Values in Octal Format

% Since four words of input are given, there are four words of input
configured for slot 1 %
% The import utility places 00000043 into the data file at address
I:1.0 %
% The import utility places 0O170000 into the data file at address
I:1.3 %

          0O000043 0O000000 0O000021 0O170000
```

Defining Timers, Counters, and Control Data Files

Enter Timer (T) and Counter (C) data in the following order: CTL, PRE, and ACC. For example:

```
   DATA T4:0 0XE000 100 0
```

Notice in the preceding example that “0XE000” indicates that control bits EN, TT and DN are set to one.

Enter the contRol (R) data values in the following order: CTL, LEN and POS. The import utility does not prevent undefined control bits from being set. Providing data for undefined control bits does not affect a program.

The control word (CTL) defines the control bits for timers (T), counters (C) and control (R) file. See tables 5.S, T, and U.

Table 5.S
Control Bits for Timers Defined by the Word CTL

Bit Address	Bit Name	Bit Number
T4:0/EN	Enable	15
T4:0/TT	Timing	14
T4:0/DN	Done	13

Table 5.T
Control Bits for Counters Defined by the Word CTL

Bit Address	Bit Name	Bit Number
C5:0/CU	Counter up enable	15
C5:0/CD	Counter down enable	14
C5:0/DN	Done; accumulator ≥ × preset value	13
C5:0/OV	Overflow	12
C5:0/UN	Underflow	11
C5:0/UA	Update accumulator (HSC only)	10
C5:0/HP	Accumulator ≥ hi preset (MicroLogix 1000 controller HSC only)	9
C5:0/LP	Accumulator ≤ lo preset (MicroLogix 1000 controller HSC only)	8
C5:0/IV	Overflow interrupt (MicroLogix 1000 controller HSC only)	7
C5:0/IN	Underflow interrupt (MicroLogix 1000 controller HSC only)	6
C5:0/IH	Hi preset interrupt (MicroLogix 1000 controller HSC only)	5
C5:0/IL	Lo preset interrupt (MicroLogix 1000 controller HSC only)	4
C5:0/PE	User interrupt pending (MicroLogix 1000 controller HSC only)	3
C5:0/LS	User interrupt is lost (MicroLogix 1000 controller HSC only)	2
C5:0/IE	Interrupt enable (MicroLogix 1000 controller HSC only)	1

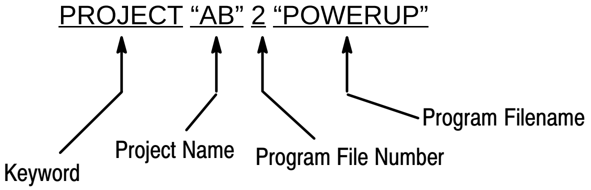
Table 5.U
Control Bits for Control Files Defined by the Word CTL

Bit Address	Bit Name	Bit Number
R6:0/EN	Enable	15
R6:0/EU	Enable Unload –or– Queued[1]	14
R6:0/DN	Done –or– Asynchronous Done[1]	13
R6:0/EM	Empty –or– Synchronous Done[1]	12
R6:0/ER	Error	11
R6:0/UL	Unload	10
R6:0/IN	Inhibit –or– Running[1]	09
R6:0/FD	Found	08

[1] When CTL is used with an ASCII instruction.

Entering the Project Name and Program File List

The project name format consists of the keyword “PROJECT”, *project name*, program *file number* and program *filename*. For example:



Use up to eight alphanumeric, underscore, or IBM–extended characters, in any combination, to specify the project name. If the project name does not match the filename of the archive file, or if the project name is left blank, the import utility uses the name of the archive file.

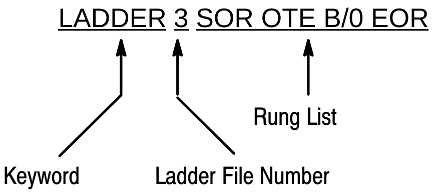
The list of program file numbers and names, if included, follows the project name. You must specify the file number first, then the filename.

The file number is an immediate integer value (2–15 for MicroLogix 1000 controllers; 2–255 for all other controllers and processors). You do not have to specify the program file numbers in order, for example: 2 “AB” 5 “A” 3 “B”.

You specify the program filename like the project name. You may use up to ten characters.

Specifying the Ladder Program Files

The ladder program filename consists of the keyword “LADDER,” the file number and, if included, the *rung list*. For example:



If you leave the rung list empty, the import utility creates the EOR instruction.

For MicroLogix 1000 controllers, files 2 to 15 are fixed ladder program files. For all other controllers and processors you can specify program files 2 to 255 as ladder program files.

A rung may consist of the following:

- start of rung symbol (SOR)
- input instructions
- output instructions
- end of rung symbol (EOR)

The import utility processes the rung left–to–right and top–to–bottom. Also, the import utility processes each branch structure before proceeding to the next instruction on a given line.

The ladder rung consists of three basic structure types described in table 5.V. Figure 5.2 shows a simple program before and after the import utility converts it from an ASCII program file into an APS ladder program. Notice how the instructions and structures in table 5.V correspond to the instructions in the ASCII program file and the rung structures in the APS ladder program in figure 5.2.

Table 5.V
The Branch Types of the Ladder Rung

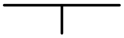
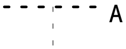
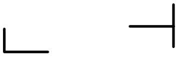
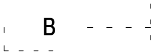
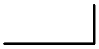
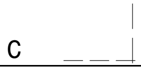
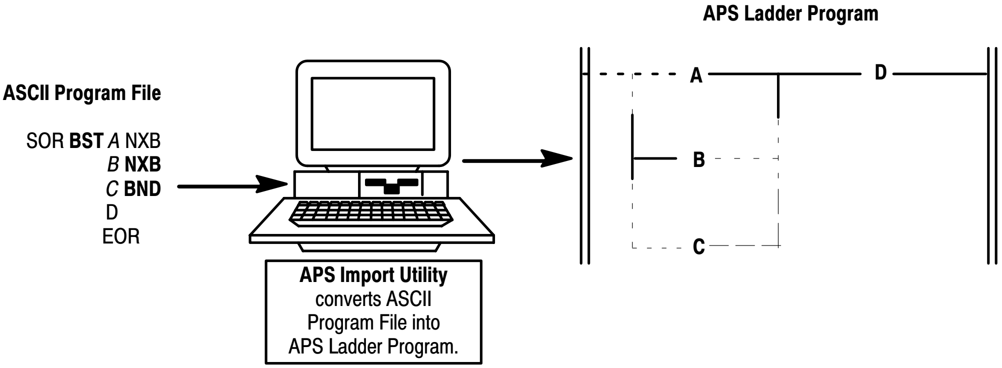
Structure Types:	Branch Type defined in ASCII:	Notice this same instruction in the ASCII Program File in Figure 5.2:	Branch Type in APS ladder programming:	Notice this same branch type in the APS Ladder Program in Figure 5.2:
Branch Start	BST	**BST *A***		
Next Branch	NXB	***B* NXB**		
Branch End	BND	***C* BND**		

Figure 5.2
Illustrating the Branch Types of the Ladder Rung



Example ASCII Program and APS Ladder Rung

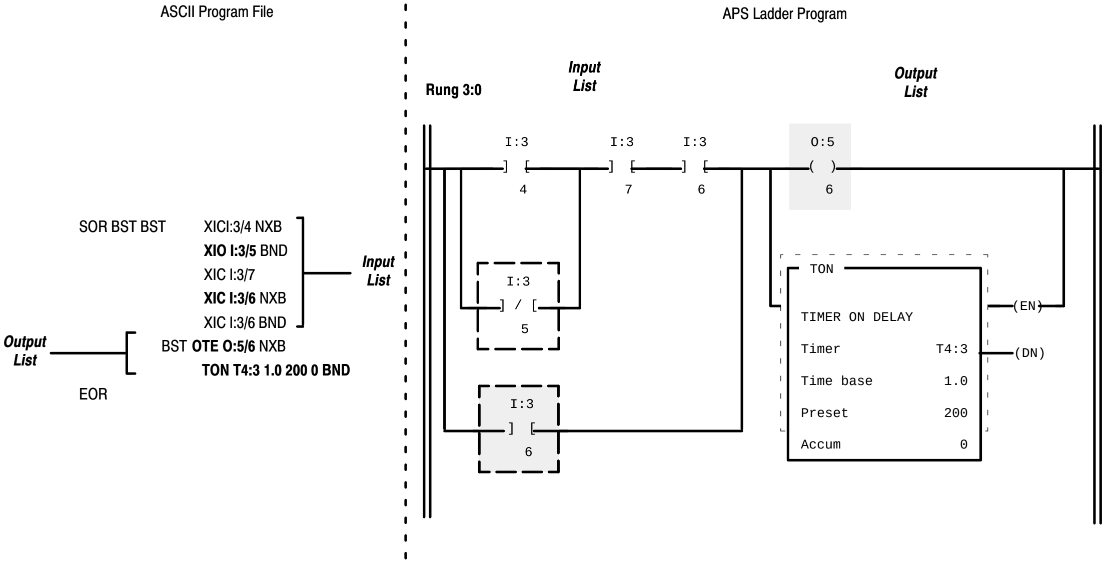
Figure 5.3 shows an example program first in ASCII file format, then in ladder format. The program consists of an input and output instruction list. Also included in the program is a timer instruction (TON). (You can leave the input instruction list empty, but not the output instruction list.) Use table 5.W to understand the comparisons made between the two programs in figure 5.3.

Note *In APS, you can nest only four levels of branches.*

Table 5.W
Key to Figure 5.3

The following ASCII Instructions (highlighted in the ASCII program below):	Specify this designated part of the APS ladder rung:
XIO I:3/5	⬚
XIC I:3/6	▨
OTE O:5/6	░
TON T4:3 1.0 200 0 BND	⬚

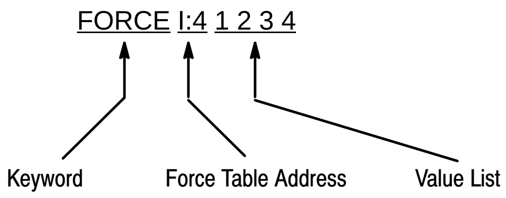
Figure 5.3
Example ASCII Program File and APS Ladder Program



```
SOR BST BST   XICI:3/4 NXB
              XIO I:3/5 BND
              XIC I:3/7
              XIC I:3/6 NXB
              XIC I:3/6 BND
           BST OTE O:5/6 NXB
              TON T4:3 1.0 200 0 BND
EOR
```

Specifying the Force Table List

The format for specifying the force table consists of the keyword “FORCE”, a *force table address* and a *value list*. For example:



The value list contains the force on and force off information for the specified force table address. You do not have to specify the value list.

When specifying the force table list, use the formats in table 5.X.

Table 5.X
Force Table Formats and Examples

Force Table Formats:	Example Force Table Entry:	The Example Force Table Entry Does the Following:
FORCE *Force_table_address*	FORCE I:4	checks if address is configured
FORCE*Force_table_address Value_list*	FORCE I:4 1 2	I:4.0 force on = 1, force off = 2
FORCE . . . *Force_table_address Value_list*	FORCE . . . O:7.4 1 2	O:7.4 force on = 1, force off = 2

Every word of I/O consists of two corresponding words of force data: one word of force on data and one word of force off data. Force data tables start with the force on word, followed by the corresponding force off word. Initialize the force data tables one slot at a time.

In the following example, the force address “FORCE I:4” initializes the first three words of input force data for slot four, forcing bits I:4.0/0 and I:4.1/4 off, while forcing bits I:4.2/0 and I:4.2/1 on. (This example assumes that you configured three or more words of input for slot four.)

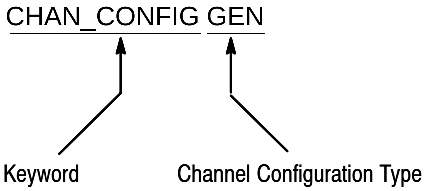
```
FORCE I:4

             % ON %     % OFF %

% I:4.0 %    0x0000      0x0001

% I:4.1 %    0x0000      0x0010

% I:4.2 %    0x0003      0x0000
```

In this example, the force address “FORCE...O:7.4” skips over the first four words of slot seven and forces bit O:7.4/0 off and bit O:7.5/8 on.

```
FORCE ...O:7.4

             % ON %     % OFF %

% O:7.4 %    0x0000      0x0001

% O:7.5 %    0x0100      0x0000
```

Specifying the Channel Configuration Data List (SLC 5/03 and SLC 5/04 Processors Only)

The required format for specifying the channel configuration data list consists of the keyword “CHAN_CONFIG” and a *channel configuration file type*. For example:



You can also specify a value list, which contains the channel configuration information for the specified channel configuration file. If you leave the list empty, APSIE initializes a default channel configuration file.

Note *While the APSIE utility verifies that the driver (as encoded as the low byte of the first word) is correct for the channel, it does not verify (range check) that the other fields are correct.*

You can also set the channel configuration file to a default driver configuration. To do this, use the default driver keyword entry.

Channel Configuration File Types

Table 5.Y defines the three file types that you can use as part of a channel configuration data list.

Table 5.Y
File Types

Channel Configuration File Types	Definition
GEN	General Configuration File
CH0SYS	Channel 0 System Mode Configuration File
CH1SYS	Channel 1 System Mode Configuration File
CH0USER	Channel 0 User Mode Configuration File

Default Drivers

The following are valid default driver entries:

- DH485
- DF1HD
- DF1FD
- ASCII
- SHUTDOWN
- DH+

Channel Configuration Formats

The following are valid channel configuration formats:

- CHAN_CONFIG channel_config_file_type

  The example below generates a default General Configuration File.

  ```
  CHAN_CONFIG GEN
  ```

- CHAN_CONFIG channel_config_file_type default_driver

  The example below generates a default DH485, Channel 0 SYSTEM Mode Configuration File.

  ```
  CHAN_CONFIG CH0SYS DH485
  ```

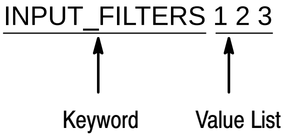
- CHAN_CONFIG channel_config_file_type value_list

  The example below generates a General Configuration File with a value list.

  ```
  CHAN_CONFIG GEN
              0x0001 0x0002 0x0003 0x0004 0x0005 0x0006
              0x0007 0x0008 0x0009 0x000A 0x000B 0x000C
  ```

Specifying the Adjustable Input Filters List (MicroLogix 1000 Controllers Only)

The format for specifying the input filters list consists of a keyword INPUT_FILTERS and a *value list*. For example:



The value list represents the maximum on delay for the filters in ms, as shown in table 5.Z.

Table 5.Z
Value List Options

Value List	Maximum on Delay for Filters (ms)
0	.075
1	.5
2	1
3	2
4	4
5	8
6	16
7	.1
8	.25

If you do not use the keyword INPUT_FILTERS, or if you leave the value list empty, APSIE initializes a default input filter setting.

The following are valid input filter formats:

- *EMPTY*

  The example below generates a default that sets all filters to 8 ms.

  ```
  !
  ```

- INPUT_FILTERS *EMPTY*

  The example below generates a default that sets all filters to 8 ms.

  ```
  !INPUT_FILTERS
  ```

- INPUT_FILTERS value list

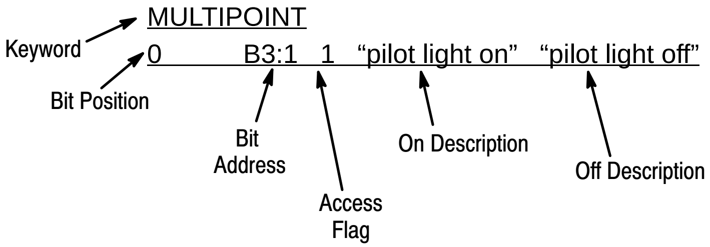
  The example below sets the filters to .5 ms, 1 ms, 2 ms.

  ```
  !INPUT_FILTERS 1 2 3
  ```

Specifying the Multi-Point I/O List

In the APS Import/Export Utility, the multi-point I/O list has been added to the ASCII archive file for use with the SLC 5/03 OS302 and SLC 5/04 OS401 processors, and MicroLogix 1000 controllers.

The format for specifying the multi-point I/O list consists of a keyword MULTIPOINT and a *bit position, bit address, access flag, on description, and off description.* For example:



```
MULTIPOINT
0         B3:1   1   “pilot light on”   “pilot light off”
```

There are 0–15 bit positions for MicroLogix 1000 controllers, and 0–31 bit positions for SLC 5/03 OS302 and SLC 5/04 OS401 processors. An error occurs if you:

- assign duplicate bit positions
- specify more than 16 value pairs
- use a bit address that is invalid for the selected controller
- assign invalid state

If you do not use the keyword MULTIPOINT, or if you leave the value list empty, APSIE initializes a default list of null values.

The following are valid multi-point I/O formats:

- *EMPTY*

  The example below generates a default list of null values.

  ```
  !
  ```

- MULTIPOINT
  EMPTY

  The example below generates a default list of null values.

  ```
  !MULTIPOINT
  ```

- MULTIPOINT
  value list

  The example below shows two entries in the list; all other positions in the list default to null values.

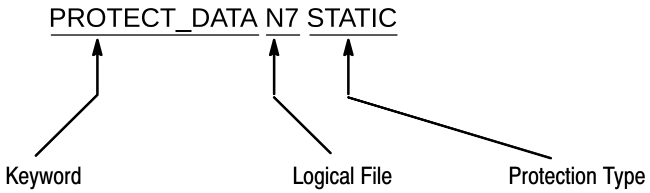
  ```
  !MULTIPOINT
  1   N7:2/12   0  “on description”  “off description”
  3   C5:0/IH   1  “on description”  “off description”
  ```

Protecting Archive Files (SLC 5/03 and SLC 5/04 Processors Only)

There are three types of file protection: data, ladder, and force.

Data File Protection

To protect a data file, place the keyword entry at the end of the data file. For example:



Note *Default data file protection is: output file = STATIC; all other files = unprotected.*

The following are example data file protection entries:

- The example below causes data file B3 to be CONSTANT protected.

  `PROTECT_DATA B3 CONSTANT`

- The example below causes data file N7 to be STATIC protected.

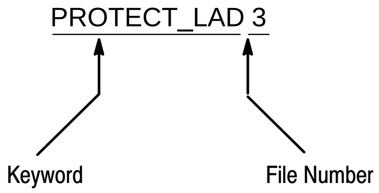
  `PROTECT_DATA N7 STATIC`

- The example below causes data file N7 to be MEMory MODule protected.

  `PROTECT_DATA N7 MEM_MOD`

Ladder File Protection

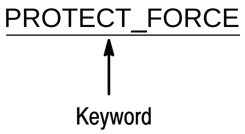
To protect a ladder file, place the keyword entry at the end of the ladder file. Also, you cannot set file protection in a program that has edit zones from an online editing session. (The APS default for file protection is no program files protected.) Use the following format:



The example above causes program file 3 to be protected.

Force File Protection

Force files can be protected against changes by using the PROTECT_FORCE keyword, as shown here:



Note *This keyword globally protects all force files.*

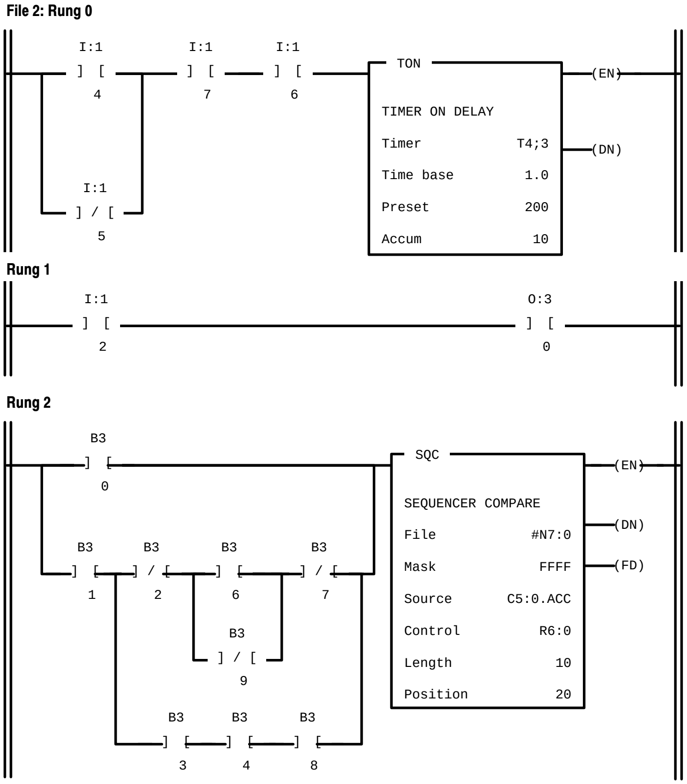
Examining ASCII Archive Files

This section provides you with two example programs, each shown as an ASCII archive file and, for comparison, as an APS ladder program.

Example Program #1

The following program example has two rungs. The first rung has a timer instruction, the second a nested branch.

APS Ladder Program



ASCII Archive File

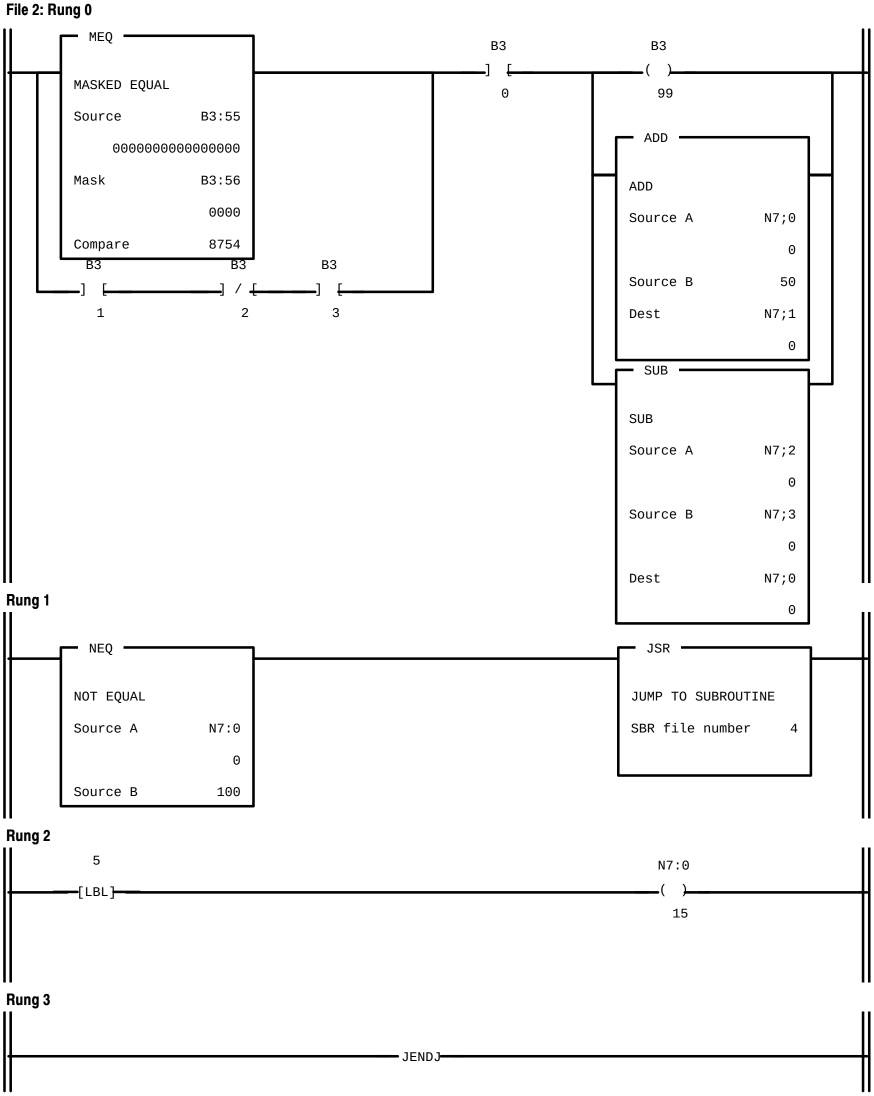
```
START 1747–L524
RACK 1 1746–A4
SLOT 1 1746–IM8
SLOT 2 1746–NI4
SLOT 3 1746–OA8
DATA O:3
0X0001    %Bit O:3.0/0 initialized to 1%
DATA ...T4:3
0XC000 100 25 % T4:3 CTL bits cleared
T4:3.PRE = 100 T4.3.ACC = 25 %

PROJECT “EX”
LADDER 2 % FILE 2 %
!RUNG 0
SOR BST XIC I:1/4 NXB
          XIO I:1/5 BND
          XIC I:1/7 XIC I:1/6 TON T4:3 1.0 200 10
EOR

!RUNG 1
SOR XIC I:1/2 OTE O:3/0 EOR
FORCE I:1
FORCE O:3




!RUNG 2
SOR BST XIC B3/0 NXB
          XIC B3/1
          BST
          XIO B3/2 BST
                    XIC B3/6 NXB
                    XIO B3/9 BND
          XIO B3/7 NXB
          XIC B3/3
          XIC B3/4
          XIC B3/8 BND
   BND
   SQC #N7:0 0xFFFF C5:0.ACC R6:0 10 20
EOR
```

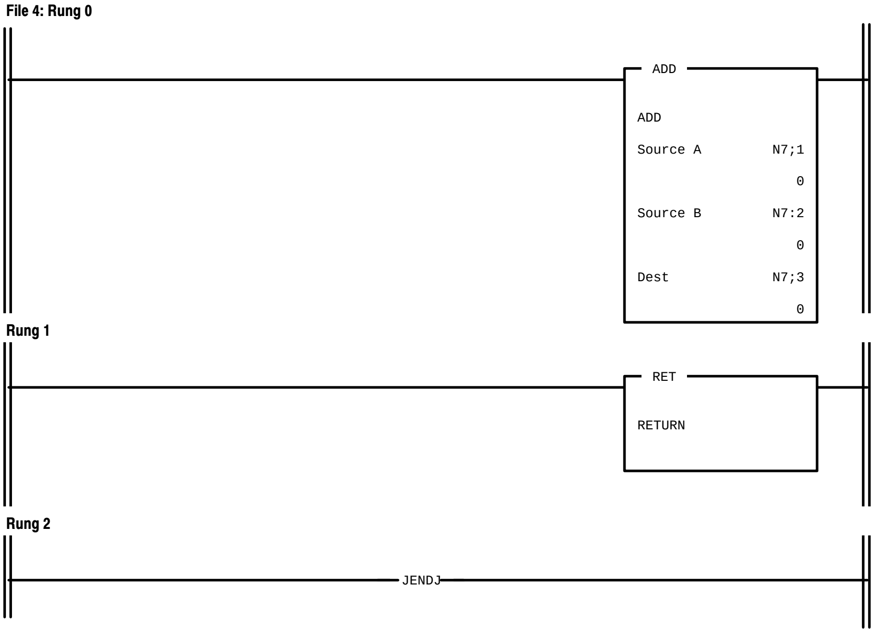
Example Program #2

This example provides you with a longer and more complex program. The key feature of this program is its subroutine.

Example program #2 in APS ladder format.

APS Ladder Program




File 4: Rung 0
ADD
ADD
Source A
N7;1
0
Source B
N7:2
0
Dest
N7;3
0
Rung 1
RET
RETURN
Rung 2
JENDJ

ASCII Archive File

```
% PROCESSOR CONFIGURATION INFORMATION %
START 1747–L511                     % 1747–L511 5/01 CPU – 1K USER MEMORY %

% PROCESSOR CHASSIS CONFIGURATION INFORMATION %
RACK 1 1746–A10 % 10–Slot Backplane %

% SLOT CONFIGURATION INFORMATION %
SLOT 2 1746–NIO4I                   % Combo Analog 2 in 2 Out Current %
SLOT 3 1746–IA16                    % 16 pt. 120 VAC Input %
SLOT 5 1747–DCM–FULL                % Full Chassis DCM %
SLOT 7 2323
SLOT 8 1746–IA16                    % 16 pt. 120 VAC Input %

% DATA TABLE INFORMATION %

DATA O:02
% O:2.0 %         0x0000      0x0000

DATA O:05
% O:5.0 %         0x0000      0x0000      0x0000      0x0000      0x0000      0x0000      0x0000      0x000
0

DATA O:07
% O:7.0 %         0x000

DATA I:02
% I:2.0 %         0x0000      0x0000

DATA I:03
% I:3.0 %         0x000

DATA I:05
% I:5.0 %         0x0000      0x0000      0x0000      0x0000      0x0000      0x0000      0x0000      0x000
0

DATA I:07
% I:7.0 %         0x000

DATA I:08
% I:8.0 %         0x00

DATA S:0
% S:0 %                0           1           0        2560           0           0           0          0
% S:8 %                0           0           0          –1          –1           0           0       1025

DATA B3:00
% B3:00 %              0           0           0           0           0           0           0          0
% B3:08 %              0           0           0           0           0           0           0          0
% B3:16 %              0           0           0           0           0           0           0          0
% B3:24 %              0           0           0           0           0           0           0          0
% B3:32 %              0           0           0           0           0           0           0          0
% B3:40 %              0           0           0           0           0           0           0          0
% B3:48 %              0           0           0           0           0           0           0          0
% B3:56 %              0           0           0           0           0           0           0          0

DATA N7:00
% N7:0 %               0           0           0           0
% PROJECT AND LADDER FILENAMES %

PROJECT EXAMPLE2 2 “MAIN_PROG” 4 “SUBR_4”

% Ladder File Information %

LADDER 2
% RUNG 0 %
SOR BST
                        MEQ B3:55 B3:56 8754 NXB
                        XIC B3/1 XIO B3/2 XIC B3/3 BND
                        XIC B3/0 BST
                        OTE B3/99 NXB
                        ADD N7:0 50 N7:1 NXB
                        SUB N7:2 N7:3 N7:0 BND
                            EOR
% RUNG 1 %
SOR NEQ N7:0 100 JSR 4 EOR
% RUNG 2 %
SOR LBL 5 OTE N7:0/15 EOR

LADDER 4
% RUNG 0 %
SOR ADD N7:1 N7:2 N7:3 EOR
% RUNG 1 %
SOR RET EOR

% FORCE TABLE INFORMATION %

FORCE O:2
% ON                 OFF                %
0x0000            0x0000            % FORCE O:2.0 %

% 0x0000          0x0000% FORCE O:2.1 %

FORCE O:5
% ON                 OFF           %
0x0000            0x0000% FORCE O:5.0 %
0x0000            0x0000% FORCE O:5.1 %
0x0000            0x0000% FORCE O:5.2 %
0x0000            0x0000% FORCE O:5.3 %
0x0000            0x0000% FORCE O:5.4 %
0x0000            0x0000% FORCE O:5.5 %
0x0000            0x0000% FORCE O:5.6 %
0x0000            0x0000% FORCE O:5.7 %

FORCE O:7
% ON                 OFF           %
0x0000            0x0000% FORCE O:7.0 %

FORCE I:2
% ON                 OFF           %
0x0000            0x0000% FORCE I:2.0 %
0x0000            0x0000% FORCE I:2.1 %

FORCE I:3
% ON                 OFF           %
0x0000            0x0000% FORCE O:7.0 %

FORCE I:5
% ON                 OFF           %
0x0000            0x0000% FORCE O:5.0 %
0x0000            0x0000% FORCE O:5.1 %
0x0000            0x0000% FORCE O:5.2 %
0x0000            0x0000% FORCE O:5.3 %
0x0000            0x0000% FORCE O:5.4 %
0x0000            0x0000% FORCE O:5.5 %
0x0000            0x0000% FORCE O:5.6 %
0x0000            0x0000% FORCE O:5.7 %

FORCE I:7
% ON                 OFF           %
0x0000            0x0000% FORCE I:7.0 %

FORCE I:8
% ON                 OFF           %
0x0000            0x0000% FORCE I:8.0 %
```

6 Creating an ASCII Documentation File

This chapter shows you how to create your own ASCII documentation file. You can use these documentation files with the import utility. This chapter consists of the following sections:

- creating ASCII documentation files
- examples of ASCII documentation files

Creating an ASCII Documentation File

When creating an ASCII documentation file, follow these guidelines:

- To create the file, use a text editor that produces only printable ASCII characters, with no control or hidden characters.
- Do not use graphics characters. IBM extended characters can be used within comment strings and as part of symbols.

The ASCII documentation file may contain one or more of the following:

- address comments
- instruction comments
- rung comments
- symbols

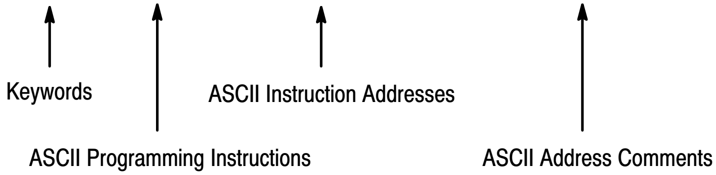
You can group statements together by keyword, or begin each statement with a keyword. The following example shows an ASCII file using grouped statements. Notice that all symbols group together after you enter the keyword “SYM”. The address comments follow the keyword “AC”. You can have the keyword appear multiple times in a file.

```
SYM
O:1.2/3     UPLOADED
O:2.1/11    EMPTY_LITE
O:10.2/4    NOZ_FILL
AC
O:11.1/6    “comment–6”
O:9.0/5     “Temporary\Storage\Point”
I:3.0/10    “Conveyor\Running”
```

Note *You must enter the keyword on a line by itself in order for the import utility to recognize that you are grouping statements.*

The example below shows an ASCII documentation file with a keyword for each statement.

```
SYM            I:0.0/0     C5UNDERFL
AC             I:0.0/0     “Totalizer Pulse Counter”
IC    XIO      I:0.0/0     “North Cutter Running”
IC    JMP      2:LBL5      “Jump to label 5”
```



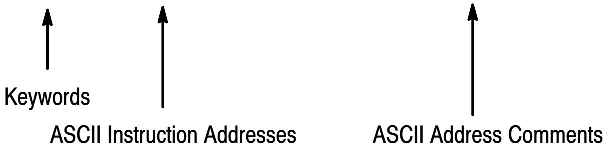
Placing Address Comments

An address comment is a text string (a maximum of 50 characters), which provides notes or remarks for an address. To enter an address comment, keep the following in mind:

- Address comments should begin and end with quotation marks (“ ”), and should follow the instruction address on the same line.
- Do not use carriage returns. If you want a carriage return to appear in a comment, use a back slash (\) in the comment to represent a carriage return. (Note that this back slash is considered a character in the 50–character limit.)
- Only the first 50 characters you enter are used in the comment. The import/export utility displays 5 lines, 10 characters per line.
- If you want a quotation mark to appear in a comment, use two adjacent quotation marks. (One of the quotation marks is considered a character in the 50–character limit.)
- If you enter a back slash in an address comment, precede the back slash with a tilde (~).

These are example address comments:

```
AC    I:0.0/0  “UPPER LOADER HYDRAULIC SOLENOID”
AC    I:0.0/1  “OUT OF TOLERANCE ALARM ACKNOWLEDGE”
AC    I:0.0/2  “AIR STOP CLOSED LIMIT SWITCH”
```



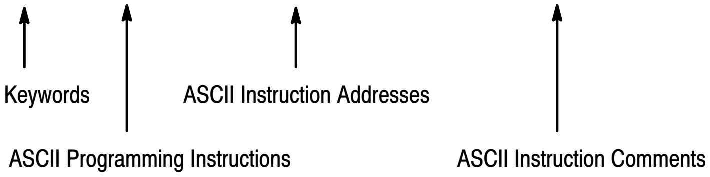
Placing Instruction Comments

An instruction comment is a text string (a maximum of 50 characters), which provides notes or remarks for an address/instruction pair. The following rules apply to instruction comments:

- Instruction comments should begin and end with quotation marks (“”), and should follow the instruction/address pair on the same line.
- Do not use carriage returns. If you want a carriage return to appear in the comment, use a back slash (\) in the comment to represent a carriage return. (Note that this back slash is considered a character in the 50–character limit.)
- Only the first 50 characters you enter are used in the comment. The import/export utility displays 5 lines, 10 characters per line.
- If you want a quotation mark to appear in your comment, use two adjacent quotation marks. (One of the quotation marks is considered a character in the 50–character limit.)
- If you enter a back slash in an instruction comment, precede the back slash with a tilde (~).

These are example instruction comments:

```
IC    XIC      N7:10/0     “Surge Tank High Level Alarm”
IC    LBL      3:LBL10     “Label 10 in ladder file 3”
IC    OTE      O:6.1/10    “North Cutter Running”
```

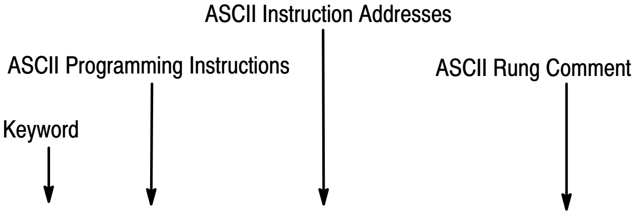

Keywords
ASCII Instruction Addresses
ASCII Programming Instructions
ASCII Instruction Comments

Placing Rung Comments

A rung comment is a text string, (up to six lines long, 80 characters each), which provides notes or remarks for an output instruction/address pair. Rung comments help identify rungs. The following rules apply to rung comments:

- Rung comments should follow the instruction/address pair on the same line. Start rung comments with opening quotation marks (“) followed by a carriage return and end with closing quotation marks (”).
- If you want a carriage return to appear in the comment, use a back slash (\). (Note that this back slash is considered a character in the 80–character limit.)
- If you enter a quotation mark in the middle of a rung comment, use two adjacent quotation marks. The initial and ending quotation marks are not included in the comment. (One of the quotation mark is considered part of the 80–character limit.)
- If you enter a back slash in a rung comment, precede the back slash with a tilde (~).

The following are example rung comments:



ASCII Instruction Addresses

ASCII Programming Instructions

ASCII Rung Comment

Keyword

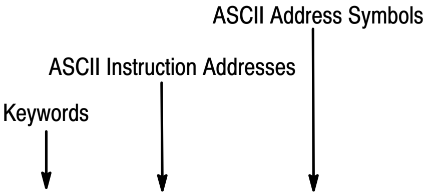
```
RC    OTE      N7:10/0     “(carriage return)
This is an example of a rung comment with quotation
marks and carriage returns at the beginning and end.
This comment is three lines long.”

RC    JMP      2:LBL5      “(carriage return)
And here is an example of “ ” and\ a back slash (use the
~ to print a back slash) without a comment:
~\IPDS~\ATTACH~\SLC500. This comment is four lines
long.”
```

Placing Symbols

A symbol is a 10–character name associated with an address. IBM extended characters can be used as part of symbols.

You start a symbol with a letter from A to Z. To complete the symbol, you can use any combination of ASCII characters except 0x00 through 0x2F and 0x3A through 0x3F.

The following are examples of symbols:



```
SYM   O:3.1/8  UPLOAD
SYM   O:5.2/3  EMPTY_LINE
SYM   I:1.1/8  PALLET
```

Annotating ASCII Documentation Files

You can add comments anywhere in the ASCII documentation file. To add a single line comment, place the comment after an exclamation mark (!). In this case, the import utility ignores all text after the exclamation mark on that line.

You may also enter comments in the ASCII documentation file by inserting the comment between two percent signs. (Tabs, carriage returns or spaces before and after the percent signs are optional.) For example: `% This is a comment %`. You may include one or more carriage returns in a comment.

Enter comments on a single line or several lines by themselves, or directly following a complete ASCII command. If the import utility encounters a comment character (% or !) between quotation marks, or a rung/instruction/address comment, it considers the comment character as part of the rung/instruction/address comment.

The following example shows you how the import utility displays comments. Notice that the comments used to document ASCII files only describe those files. The import utility does not store these comments in the database.

```
!Begin import file comments with an exclamation
!mark. as you see here. You can document your A-B
!ASCII file as you would a program.

SYM  I:1.1/8 PALLET       !This is a comment after a complete line.
SYM  %This is a comment%  I:1.1/5 %This is another comment% HI_ALARM
%This is a comment that spans
multiple lines%
```

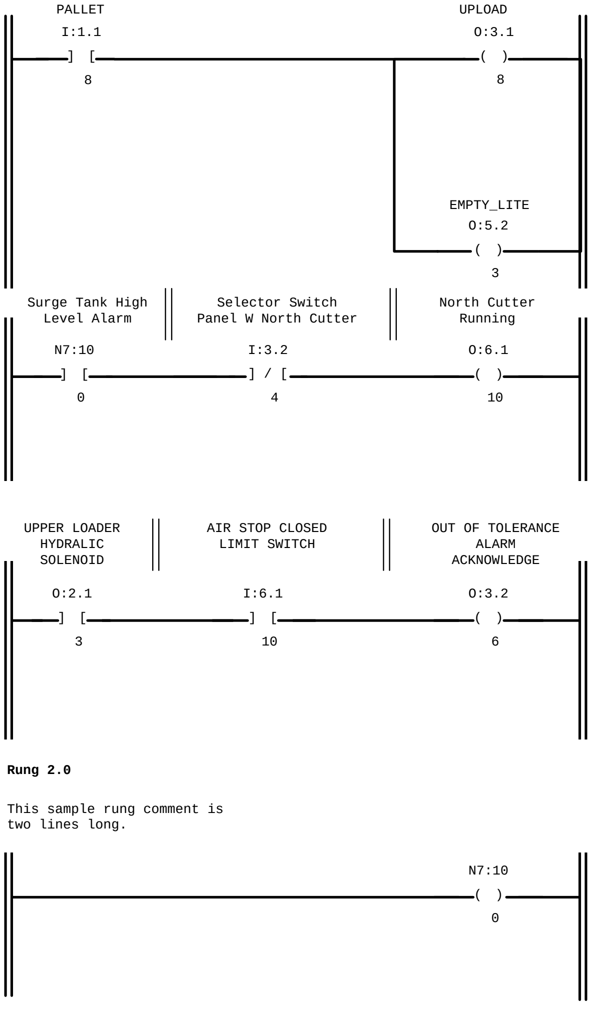
Example ASCII Documentation File

This example ASCII documentation file shows you how the import utility places comments (address, instruction, and rung) and symbols on the APS ladder rung. (The ASCII documentation files are grouped by keyword.)

ASCII Documentation File

```
!This is a sample of a complete ASCII documentation file.

SYM
O:3.1/8     UPLOAD
O:5.2/3     EMPTY_LITE
I:1.1/8     PALLET

IC
XIC         N7:10/0     “Surge Tank High Level Alarm”
XIO         I:3.2/4     “Selector Switch Panel W North Cutter”
OTE         O:6.1/10    “North Cutter Running”

AC
O:2.1/3     “UPPER LOADER HYDRALIC SOLENOID”
I:3.2/6     “OUT OF TOLERANCE ALARM ACKNOWLEDGE”
I:6.1/10    “AIR STOP CLOSED LIMIT SWITCH”

RC          OTE N7:10/0
“This sample rung comment is
two lines long.”
```

APS Ladder Program


PALLET
I:1.1
] [
8
UPLOAD
O:3.1
( )
8
EMPTY_LITE
O:5.2
( )
3
Surge Tank High Level Alarm
Selector Switch Panel W North Cutter
North Cutter Running
N7:10
] [
0
I:3.2
] / [
4
O:6.1
( )
10
UPPER LOADER HYDRALIC SOLENOID
AIR STOP CLOSED LIMIT SWITCH
OUT OF TOLERANCE ALARM ACKNOWLEDGE
O:2.1
] [
3
I:6.1
] [
10
O:3.2
( )
6
Rung 2.0
This sample rung comment is two lines long.
N7:10
( )
0

A Programming Instruction References

This appendix lists all of the available programming instructions along with their parameters, valid addressing modes, and file types.

Valid Addressing Modes and File Types

The following addressing modes are available:

Addressing Mode	Example
Direct	N7:0
Indexed Direct	#N7:0
Indexed	N7:[N10:3]
Indexed Indirect	#N7:[N10:3]

The following file types are available:

O	Output
I	Input
S	Status
B	Binary
T	Timer
C	Counter
R	Control
N	Integer
F	Float[1]
A	ASCII[1]
ST	String[1]
M	M0/M1[2]

- Immediate – indicates that a constant is a valid file type

[1] Supported only by SLC 5/03 OS301, OS302 and SLC 5/04 OS400, OS401 processors.

[2] Not supported by MicroLogix 1000 controllers.

Instruction	Description	Instruction Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
ABL[1]	ASCII Test Buffer for Line	channel			0
		control	direct	R	none
		characters			0–1024
ABS[2]	Absolute Value	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
ACB[1]	ASCII Number of Characters in Buffer	channel			0
		control	direct	R	none
		characters			0–1024
ACI[1]	ASCII String to Integer	source	direct, indirect	ST	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
ACL[1]	ASCII Clear Buffer	channel			0
		transmit buffer			0=no or 1=yes
		receive buffer			0=no or 1=yes
ACN[1]	ASCII String Concatenate	source A	direct, indirect	ST	none
		source B	direct, indirect	ST	none
		destination	direct	ST	none
ACS[2]	Arc Cosine	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[1] Supported only by SLC 5/03 OS301, OS302 and SLC 5/04 OS400, OS401 processors.

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

Instruction	Description	Instruction Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
ADD	Add	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
AEX[1]	ASCII String Extract	source	direct, indirect	ST	none
		index	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	1–82
		number	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	1–82
		destination	direct	ST	none
AHL[1]	ASCII Set/Reset Handshake Lines	channel			0
		AND mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	0–FFFF
		OR mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	0–FFFF
		control	direct	R	none
		channel status			0–001F
AIC[1]	ASCII Integer to String	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct	ST	none
AND	Logical AND	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none

[1] Supported only by SLC 5/03 OS301, OS302 and SLC 5/04 OS400, OS401 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
ARD[1]	ASCII Read Characters	channel			0
		destination	direct	ST	none
		control	direct	R	none
		string length			0–82
		characters read			0–82
ARL[1]	ASCII Read Line	channel			0
		destination	direct	ST	none
		control	direct	R	none
		string length			0–82
		characters read			0–82
ASC[1]	ASCII String Search	source	direct, indirect	ST	none
		index	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	1–82
		search	direct, indirect	ST	none
		result	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
ASN[2]	Arc Sine	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
ASR[1]	ASCII String Compare	source A	direct, indirect	ST	none
		source B	direct, indirect	ST	none
ATN[2]	Arc Tangent	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[1] Supported only by SLC 5/03 OS301, OS302 and SLC 5/04 OS400, OS401 processors.

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
AWA[1]	ASCII Write with Append	channel			0
		source	direct	ST	none
		control	direct	R	none
		string length			0–82
		characters sent			0–82
AWT[1]	ASCII Write	channel			0
		source	direct	ST	none
		control	direct	R	none
		string length			0–82
		characters sent			0–82
BSL	Bit Shift Left	file	indexed direct indexed indirect	O, I, S, B, N, A, ST	none
		control	direct	R	none
		bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		length			0–2048
BSR	Bit Shift Right	file	indexed direct indexed indirect	O, I, S, B, N, A, ST	none
		control	direct	R	none
		bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		length			0–2048
CLR	Clear	destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[1] Supported only by SLC 5/03 OS301, OS302 and SLC 5/04 OS400, OS401 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
COP	Copy File	source	indexed direct indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		destination	indexed direct indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		length			1–128
COS[2]	Cosine	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
CPT[2]	Compute	destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		expression			<expression>
CTD	Count Down	counter	direct	C	none
		preset			–32,768–32,767
		accum			–32,768–32,767
CTU	Count Up	counter	direct	C	none
		preset			–32,768–32,767
		accum			–32,768–32,767
DCD	Decode 4 to 1 of 16	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
DDV	Double Divide	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
DEG[2]	Radians to Degrees	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
DIV	Divide	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
ENC[3]	Encode 1 of 16 to 4	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
EQU	Equal	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
FFL[4]	FIFO Load	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M[7]	–32,768–32,767
		FIFO array	indexed direct indexed indirect	O, I, S, B, N, A	none
		FIFO control	direct	R	none
		length			1–128
		position			0–127
FFU[4]	FIFO Unload	FIFO array	indexed direct indexed indirect	O, I, S, B, N, A	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M[7]	none
		FIFO control	direct	R	none
		length			1–128
		position			0–127

[3] Supported only by MicroLogix 1000 controllers.

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

[7] Indexed addressing is not allowed when using T, C, R, or M addresses.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
FLL	Fill File	source	direct, indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	indexed direct indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		length			1–128
FRD	From BCD to Binary	source (SLC 5/01)	direct	O, I, S, B, T, C, R, N, A, ST, M	none
		source (SLC 5/02, SLC 5/03, SLC 5/04, MicroLogix 1000 controllers)	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
GEQ	Greater Than or Equal	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
GRT	Greater Than	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
HSC⑥	High–Speed Counter (SLC 5/01)	counter			none
		preset			1–32,767
HSC③	High–Speed Counter	type			0–7
		counter	direct	C	none
		preset			–32,768–32,767
		accum			–32,768–32,767
HSD③	HSC Interrupt Disable	counter	direct	C	none
HSE③	HSC Interrupt Enable	counter	direct	C	none

③ Supported only by MicroLogix 1000 controllers.

⑥ Supported only by L20, L30, and L40 processors with DC inputs.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
HSL[3]	HSC Load	counter	direct	C	none
		source	direct	B and N	none
		length			always 5
IID[7]	I/O Interrupt Disable	slots			double hex word (list of slots)
IIE[7]	I/O Interrupt Enable	slots			double hex word (list of slots)
IIM	Immediate Input with Mask	slot	direct	I	none
		mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		length (SLC 5/03 and SLC 5/04)			1–32
INT[4]	I/O Interrupt				none
IOM	Immediate Output with Mask	slot	direct	O	none
		mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		length (SLC 5/03 and SLC 5/04)			1–32
JMP	Jump	label number			0–999
JSR	Jump to Subroutine	subroutine file number			3–255
LBL	Label Declaration	label number			0–999

[3] Supported only by MicroLogix 1000 controllers.

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

[7] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
LEQ	Less Than or Equal To	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
LES	Less Than	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
LFL[4]	LIFO Load	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M[5]	–32,768–32,767
		LIFO array	indexed direct indexed indirect	O, I, S, B, N, A	none
		LIFO control	direct	R	none
		length			1–128
		position			0–127
LFU[4]	LIFO Unload	LIFO array	indexed direct indexed indirect	O, I, S, B, N, A	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M[5]	none
		LIFO control	direct	R	none
		length			1–128
		position			0–127
LIM[4]	Limit Test (circ)	low limit	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		test	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		high limit	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

[5] Indexed addressing is not allowed when using T, C, R, or M addresses.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
LN[2]	Natural Log	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
LOG[2]	Log to the Base 10	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
MCR	Master Control Relay				none
MEQ	Mask Compare Equal To	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		source mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		compare	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
MOV	Move	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
MSG (5/02 only)	Message	read/write			0=read,1=write
		target device			2=500CPU, 4=485CIF
		control block	direct	N	none
		control block length			7
		local address	direct	O, I, S, B, T, C, R, N, A	none
		target node			0–31
		target address	direct	O, I, S, B, T, C, R, N, A	0–255
		message length		T, C, R	1–13
				I, O, S, B, N	1–41

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
MSG (5/03 and 5/04 only)	Message	type			64=peer-to-peer
		read/write			0=read, 1=write
		target device			2=500CPU, 4=485CIF, 8=PLC5
		local/remote			16=local, 32=remote
		control block	direct	N	none
		control block length			14
		channel number			0 or 1
		target node			0–31, 0–254 if 485CIF
		remote bridge link ID			0–254, 0 when local
		remote bridge node address			0–254 0 when local
		local bridge node address			0–254, 0xFFFF when local
		local file address	direct	O, I, S, B, T, C, R, N, F, A, ST, M[8]	none
		target file address	direct	O, I, S, B, T, C, R, N, F, A, ST, M[8]	0–255
		message length		O, I, S, B, N, A[8]	1–103
				F[8]	1–51
				T	1–34 or if PLC5: 1–20
				C, R	1–34
				ST[8]	2 or if PLC5: 1
		message timeout			0–255

[8] File types F, A, and ST only apply to SLC 5/03 OS301 or later and SLC 5/04.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
MUL	Multiply	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
MVM	Masked Move	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		source mask	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
NEG	Negate	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
NEQ	Not Equal To	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
NOT	Logical NOT	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
OR	Logical OR	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
OSR	One–Shot Rising	bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST	none

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
OTE	Output Energize	bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
OTL	Output Latch	bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
OTU	Output Unlatch	bit address	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
PID[7]	PID	control block	direct	N	none
		process variable	direct, indirect	O, I, B, T, C, R, N, A	none
		control variable	direct, indirect	O, I, B, T, C, R, N, A	none
		control block length			23 always
RAC[3]	HSC Reset Accumulator	counter	direct	C	none
		source	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767 f-min–f-max
RAD[2]	Degrees to Ratians	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
REF[7]	I/O Refresh	channel 0 (SLC 5/03 and SLC 5/04)			0=no, 1=yes
		channel 1 (SLC 5/03 and SLC 5/04)			0=no, 1=yes
RES	Timer/Counter Reset	structure	direct	T, C, R	none
RET	Return				none
RPI[7]	Reset Pending Interrupt	slots			double hex word (list of slots)

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

[3] Supported only by MicroLogix 1000 controllers.

[7] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
RTO	Retentive Timer On	timer	direct	T	none
		time base (SLC 5/01)			0.01 only
		time base (SLC 5/02, SLC 5/03, SLC 5/04, MicroLogix 1000 controllers)			0.01 or 1.00
		preset			0–32,767
		accum			0–32,767
SBR	Subroutine				none
SCL[4]	Scale	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		rate	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		offset	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
SCP[2]	Scale with Parameters	input	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
		input min.	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		input max.	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		scaled min.	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		scaled max.	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		scaled output	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
SIN[2]	Sine	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
SQC	Sequencer Compare	file	indexed direct indexed indirect	O, I, S, B, N, A, ST	none
		mask	direct, indexed direct[5] indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		source	direct, indexed direct[5] indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		control	direct	R	none
		length			1–255
		position			0–255
SQL[4]	Sequencer Load	file	indexed direct indexed indirect	O, I, S, B, N, A, ST	none
		source	direct, indexed direct[5] indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		control	direct	R	none
		length			1–255
		position			0–255

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

[5] Indexed addressing is not allowed when using T, C, R, or M addresses.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
SQO	Sequencer Output	file	indexed direct indexed indirect	O, I, S, B, N, A, ST	none
		mask	direct, indexed direct[5] indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct[5] indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		control	direct	R	none
		length			1–255
		position			0–255
SQR[4]	Square Root	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
STD[4]	Selectable Timed Interrupt Disable				none
STE[4]	Selectable Timed Interrupt Enable				none
STS[4]	Selectable Timed Interrupt Start	file	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	0, 3–255 except MicroLogix 1000 controllers always equal 5
		time	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	0–255 (SLC 5/02 and MicroLogix 1000), 0–32,767 (SLC 5/03 and 5/04)
SUB	Subtract	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,76 f-min–f-max
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[4] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors and MicroLogix 1000 controllers.

[5] Indexed addressing is not allowed when using T, C, R, or M addresses.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
SUS	Suspend	suspend ID			–32,768–32,767
SVC[7]	Service Communications	channel 0 (SLC 5/03 and SLC 5/04)			0=no, 1=yes
		channel 1 (SLC 5/03 and SLC 5/04)			0=no, 1=yes
SWP[2]	Swap	source	indexed direct indexed indirect	B, N, A, ST	none
		length			1–128: bit, 1–128: integer, 1–41: string, 1–128: ASCII
TAN[2]	Tangent	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none
TND	Temporary End				none
TOD	Convert to BCD	source	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
		destination	direct	O, I. S. B. T, C, R, N, A, ST, M	none
TOF	Timer Off Delay	timer	direct	T	none
		time base (SLC 5/01)			0.01 only
		time base (SLC 5/02, SLC 5/03, SLC 5/04, MicroLogix 1000 controllers)			0.01 or 1.00
		preset			0–32,767
		accum			0–32,767

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

[7] Supported only by SLC 5/02, SLC 5/03, and SLC 5/04 processors.

Instruction	Description	Parameter	Valid Addressing Mode(s)	Valid File Types	Immediate Values
TON	Timer On Delay	timer	direct	T	none
		time base (SLC 5/01)			0.01 only
		time base (SLC 5/02, SLC 5/03, SLC 5/04, MicroLogix 1000 controllers)			0.01 or 1.00
		preset			0–32,767
		accum			0–32,767
XIC	Examine On (Examine if Closed Contact)	source bit	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
XIO	Examine Off (Examine if Open Contact)	source bit	direct, indirect	O, I, S, B, T, C, R, N, A, ST, M	none
XOR	Logical Exclusive OR	address A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		address B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	–32,768–32,767
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, A, ST, M	none
XPY[2]	X to the Power of Y	source A	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		source B	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	–32,768–32,767 f-min–f-max
		destination	direct, indexed direct indirect, indexed indirect	O, I, S, B, T, C, R, N, F, A, ST, M	none

[2] Supported only by SLC 5/03 OS302 and SLC 5/04 OS401 processors.

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